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APRIL 15, 1960

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15 kW transformer rectifier unit

From a 200 volts three phase 320/500 cycle supply the unit gives up to 500 amps. d.c. at 28 volts for general aircraft services.

Two electrically displaced six-phase transformer circuits are paralleled to give an equivalent twelve-phase rectified output, with an inherent low ripple characteristic.

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Aircraft and Atomic Energy Group, Aircraft Electrical Division

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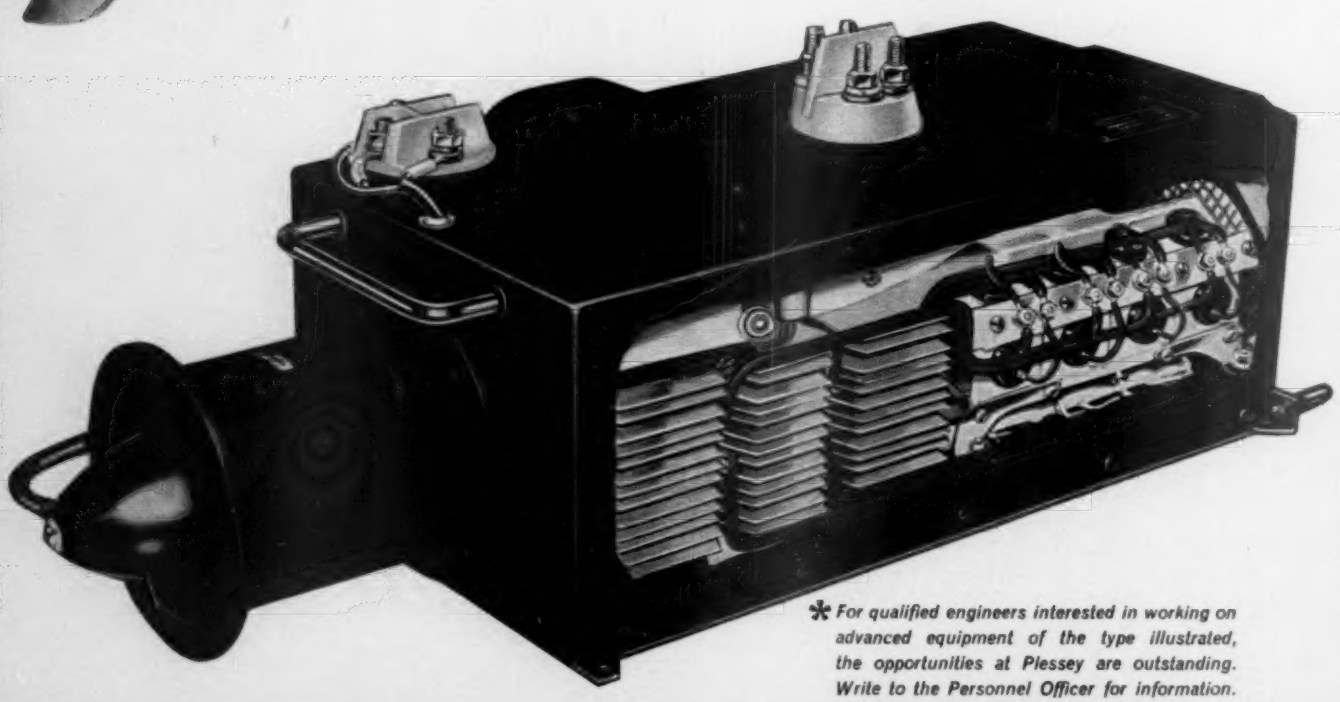

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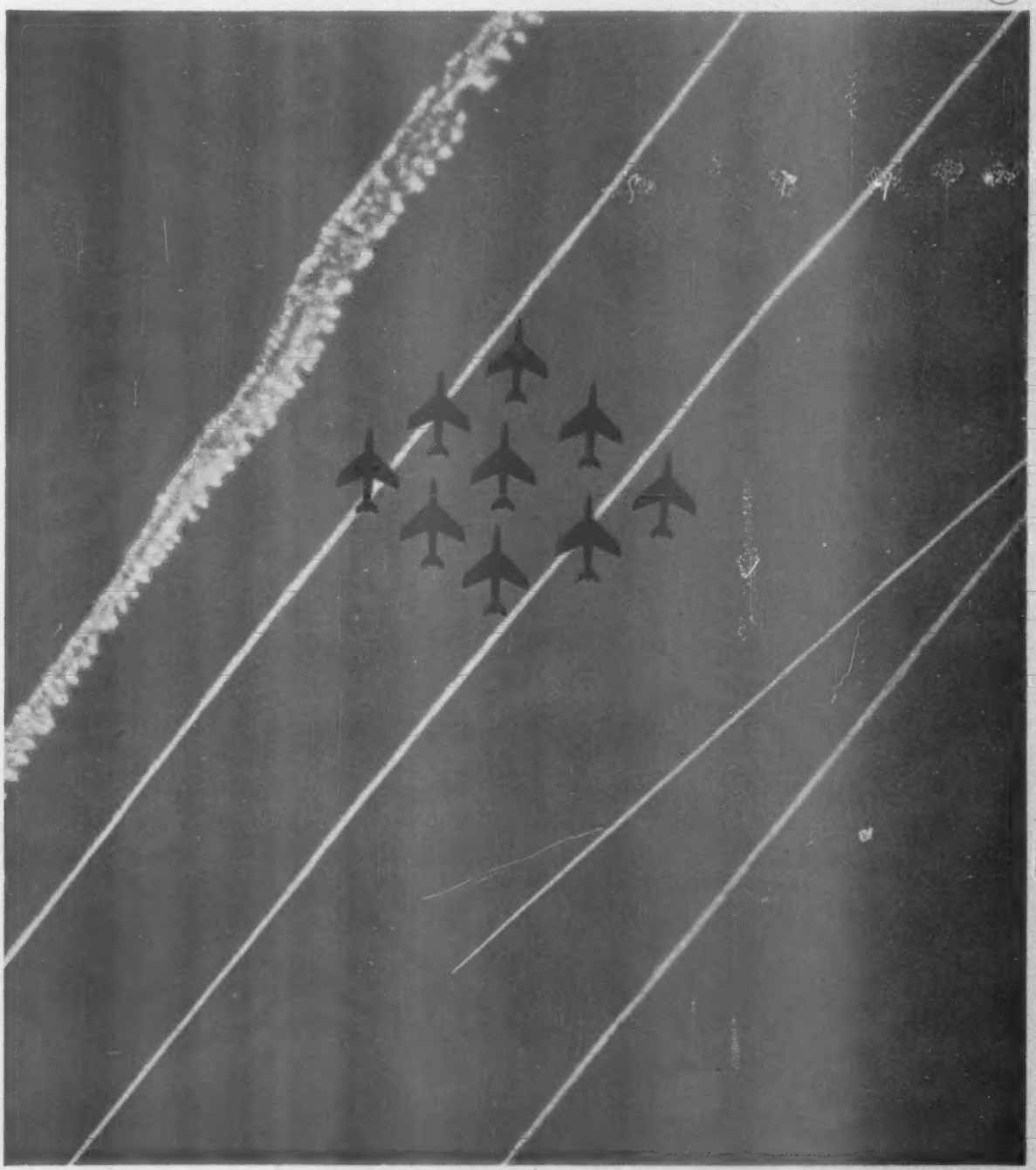
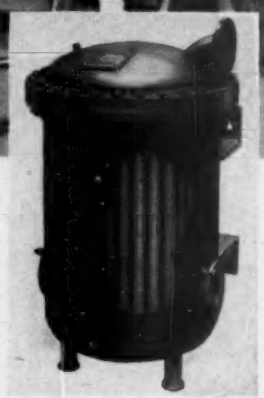


A Flight Photograph



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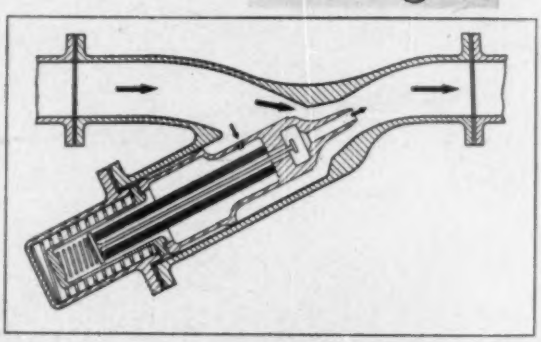
The use of Stream-Line Filters in the refuelling of aircraft ensures the removal of water and solid impurities from the fuel enabling complete fulfilment of official specifications.

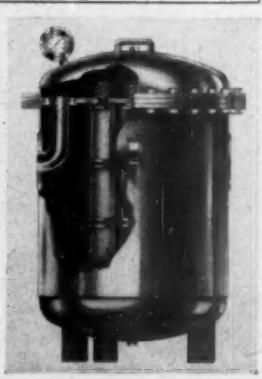
Top right is type K, a highly efficient filter consisting of a number of specially prepared paper discs compressed by springs and mounted on metal rods.

Fuel passes through the minute interstices between the discs leaving solid impurities at the edges. Any water present causes the paper to swell, with a consequent increase of back pressure, which gives an indication that servicing is needed.

Middle right is the Fuel Monitor designed in conjunction with the Shell Petroleum Company Ltd. This is a fully "fail-safe" device consisting of a valve and a water sensitive element continuously sampling the flow of fuel and causing the main valve to close if water contaminated fuel is revealed.

Bottom right is the high-output MC filter, giving what is for many purposes an acceptable filtration efficiency at a much higher rate than the K type.





NEW THREE STAGE FILTER. Stream-Line Filters Ltd., have recently developed a three-stage filter/water separator which uses pleated elements made from paper, fibreglass and nylon to remove from aviation fuels all solid impurities and all water in whatever proportions they may arise.

STREAM-LINE FILTERS for aircraft refuelling

STREAM-LINE FILTERS LTD., HENLEY PARK, NORMANDY, NR. GUILDFORD, SURREY.

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SF 102

The new Boeing 720 offers airlines the lowest seat-mile cost of any jetliner

The newest jetliner in the world—the Boeing 720—is pictured above during a recent test flight. Delivery of the first 720 is scheduled for this spring. To date, forty-six Boeing 720s have been ordered by leading world airlines.

The new 720 is designed to operate efficiently and profitably over short-to-medium range routes. The 720 cruises at speeds in excess of 600 miles an hour, and has the lowest seat-mile cost of any jetliner. In addition, the 720 can operate more economically from shorter fields than any other jetliner. Seating capacity ranges from 80 to 150 passengers, allowing airlines unusual flexibility in seating arrangements.

As demonstrated by Boeing jets already in service, the 720 will bring airlines unprecedented passenger appeal and high daily utilization.

Boeing 707 jets have already flown more than 76,300,000 miles in scheduled operations and have carried more than three million passengers.

BOEING 720

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Powered by the Bristol Siddeley Viper

in service with the Royal Air Force

With pride we announce the continuing exclusive use of HUNTING designed and manufactured primary/basic trainers in the Royal Air Force.

After the most thorough evaluation ever given to any training aircraft, the Jet Provost T.Mk.3. is now in operation at Royal Air Force Basic Flying Training Schools.

Similar to the T.Mk.3. but fitted with armament in addition, the Jet Provost T.Mk.51. is in service with the Royal Ceylon Air Force.

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AP390

THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2530 APRIL 15, 1960

An Entente Aéronautique

Wisdom and firmness, General de Gaulle told the Houses of Parliament, are the keys that alone can save the World in its present plight. And for the exercise of these qualities, he reminded his hearers, France and Great Britain are specially qualified.

It will be no bad thing to turn from the realm of World affairs which the President of France's Fifth Republic was surveying, and to consider whether the exercise of firmness and wisdom in the specific field of aviation might not, even yet, result in a somewhat closer working together between the aeronautical fraternities of our two countries. There have been close links between the Air Forces for years. Their existence was made manifest by the recent visit of No. 12 Wing of France's L'Armée de l'Air to Fighter Command at Wattisham last week. It is only a few weeks ago that the thirteenth Louis Blériot Memorial lecture was held. This annual function, held alternately in London and Paris, marks the working together of *L'Association Française des Ingenieurs et Techniciens de l'Aéronautique* with our own Royal Aeronautical Society. On the industrial side it is many years since a link was forged between the Bristol Company and Gnôme et Rhône whose name is a reminder, if any were needed, of what the earliest British aviators owed to France's aeronautical talent. Today, the tradition of co-operation in the field of propulsion is exemplified by the services given by Rolls-Royce engines to France's aeronautical products.

It is because of these long-standing links that many people in this country were disappointed that nothing came of the efforts so vigorously made in France to have the Caravelle built over here. Today that task is to be undertaken in the United States and as one result American aircraft manufacturers are looking into the possibility of acquiring licences to build British airliners of the next generation.

In this issue we record the vigorous recommendations set forth by the Air League that this country should undertake the development and production of a M=3 VTOLiner. There is a strong body of opinion in this country which believes that the building of a supersonic airliner should be done in collaboration with the United States. Another body of opinion considers that this would not prove workable as U.S. manufacturers, or some of them, are confident of their ability to proceed alone.

We are surprised not to have heard any suggestion for exploring the possibility of joint Franco-Britannic action in the matter of developing a supersonic airliner. Such collaboration would certainly provide an answer to those who feel that for this country to go it alone would put a heavy drain on the public purse.

There is no doubt that we on our island, in spite of our inbred insularity, are beginning to see that economically we are part of a much larger pattern. At the moment the States of Western Europe are literally at sixes and sevens, but at least a considerable degree of combination for economic activity has already taken place. There are plenty of people who feel that not enough has been done in the context of NATO to integrate European aeronautical activity. Indeed, all the signs are that the activity which has so far taken place has resulted in a closer collaboration between the American aircraft industry and its European counterparts.

In considering the significance and likely outcome of General de Gaulle's visit, would we not be wise firmly to investigate the possibilities of Franco-British collaboration in the matter of supersonic transportation?

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Matters of Moment

The Future of Handley Page

REPORTS from the City continue to circulate that a link is to be expected between Handley Page and the Hawker Siddeley group. But no mention has been made on the effect that such a combination might have on the future of the Dart Herald and on that of the Avro 748, which is expected to fly shortly. It is scarcely to be expected that both types would, in the event of such combination, be produced in parallel.

S.B.A.C. Show 1960

THIS year the S.B.A.C. Show, the twenty-first, will open on Sept. 5 at Farnborough. The public will be admitted on Sept. 9, 10 and 11.

The floor space in the Exhibition building will be the same as in 1959 but the actual stand space, including the equipment display, will be greater than ever before. Space for equipment manufacturers will be increased by about one-third and airframe and aero-engine manufacturers will be allotted an extra 8,000 sq. ft. If present plans mature, the missile park will be about one-third larger than it was last year.

Hawker Siddeley and the British Aircraft Corporation will each have a consolidated stand covering 7,500 sq. ft. and Westland will have 2,000 sq. ft. This total, 17,000 sq. ft., will be 7,000 sq. ft. more than the companies which make up the new groups had last year.

The main aero-engine companies, Bristol Siddeley and Rolls-Royce, will each have 2,000 sq. ft.; their total will be 1,000 sq. ft. more than in 1959.

Although the extra area allotted to stands will mean less room for gangways and open spaces in the building, the S.B.A.C. states that the layout has been redesigned so that visitors to the exhibition will be able to move around as freely as in previous years.

A Fairey Resignation

MR. R. L. LICKLEY, B.Sc., D.I.C., M.I.Mech.E., F.R.Ae.S., technical director of the Fairey Co., Ltd., has resigned from the board and relinquished his appointments with the subsidiary companies in the Fairey Group. He has given no indication of his future plans.

Educated at Edinburgh University and Imperial College, he started his aeronautical career with the Hawker company, subsequently becoming chief project engineer. Leaving Hawker he went to the College of Aeronautics at Cranfield in 1946 as professor of aircraft design. He left Cranfield in 1951 to join Fairey Aviation as chief engineer and was appointed to the board as technical director in 1956.

Westland Board Changes

FOLLOWING its acquisition of Fairey Aviation and the helicopter division of Bristol Aircraft—supplementing the earlier take-over of the Saunders-Roe aircraft activities—Westland Aircraft has reorganized its board of directors to cover the various components now forming this large single specialist helicopter group. The two latest additions are principally represented by Sir Reginald Verdon Smith, chairman of Bristol Aeroplane Co., Ltd., and Mr. C. H. Chichester Smith, managing director of the Fairey Co., Ltd., who have joined the Westland board.

With Mr. E. Mensforth remaining as chairman, Mr. E. C. Wheeldon, Westland's managing director, also becomes joint deputy chairman with Lord Aberconway. Mr. D. H. Hollis Williams, the technical director, and Mr. W. Oppenheimer, financial director, have been appointed assistant managing directors of the new board. Mr. A. R. B. Hobbs becomes the company's secretary.

Westland Aircraft now comprises four divisions. Each of these is represented on the board by special directors. These board appointments are as follows:—

Yeovil Division—Mr. E. J. Boulger, Group contracts manager; Mr. O. L. L. Fitzwilliams, chief engineer; Mr. E. J. Frost, works manager; Mr. C. T. Jones, Group insurance manager; Mr. H. J. Penrose, Group sales manager. Saunders-Roe Division—Mr. M. W. C. Gordon, general manager. Bristol Division—Mr. R. Hafner, chief engineer. Fairey Division—Mr. H. W. D. Winkworth, general manager; and Dr. G. S. Hislop, chief engineer. Mr. Winkworth, until his new appointment, was director in charge of the Saunders-Roe Division, where he had been works director.

In a statement to the shareholders Mr. Mensforth discloses that after the new company acquisitions have been completed, the Group's consolidated assets will be approximately £11.5 million. Bristol's helicopter activities at present, he says, consist in the main of the development and production of the Type 192 twin-rotor helicopter intended for the Army and capable of carrying some 18 fully equipped troops.

Fairey production at present includes the Gannet AEW.3 and a substantial contract for the reconditioning of an earlier model of the Gannet for the Indonesian Government is also in hand. These contracts should, says Mr. Mensforth, make a useful contribution to Westland's profits in the next two years, but after work on the Gannet is completed further contracts for fixed-wing aircraft are not expected. A "substantial contribution" by the company would be needed for the development of the Tyne-Rotodyne—a contract for which was placed by the Government in February.

Canadian Satellite Agreement

ARRANGEMENTS have been completed between the Defence Research Telecommunications Establishment of Canada and America's National Aeronautics and Space Administration for a joint project to study the ionosphere by means of a sweep frequency sounder satellite. The vehicle is expected to be launched by a three-stage Delta rocket in 1961.

According to the agreement, the DRTE will provide the satellite and its instrumentation and will operate a network of receiving stations within Canada for recovering telemetered data. NASA will provide high-altitude sounding rockets and launching services to test prototype instruments for the Canadian satellite, the satellite launching vehicle, and launching facilities. The Americans will also be responsible for ground-based telemetry and recording equipment outside Canada to recover telemetered data for at least a year.

Objectives of the project are to extend contemporary knowledge of the characteristics of the upper regions of the ionosphere. Although existing ground stations can obtain information by reflecting radio waves from the bottom of the ionosphere, the satellite—launched on a polar orbit—will permit studies to be made over Canada and South America as well as the United States.

More About Supersonic Engines

A DISTINGUISHED powerplant specialist from America. Mr. J. S. Alford, A.F.R.Ae.S., design engineer of the General Electric Company, is visiting this country next month to give the second Halford Memorial Lecture, before the Hatfield Branch of the Royal Aeronautical Society. He has chosen for his subject a topic of widespread interest at the present time—powerplants for supersonic transport—and his lecture promises to be well worth hearing. It is to be on May 11 at 18.30 hrs. in the Central Hall of Hatfield Technical College.

A synopsis sent to us by the R.Ae.S. indicates that the lecturer proposes to analyse operating experience with air-breathing

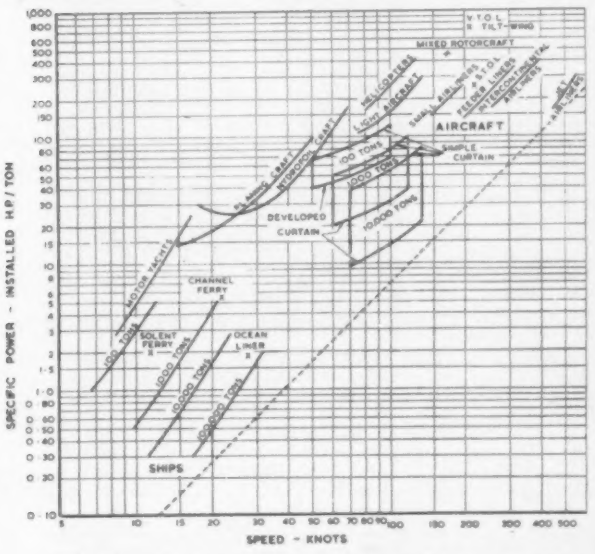
SEEING BRISTOL SIDDELEY.—A party from the German Dornier Werke, paid a visit to Bristol Siddeley Engines recently. Left to right are: Dr. Jaegar, Dornier chief designer; Mr. N. R. Quinn; Mr. A. C. Pitt; Dr. P. Dornier; Dr. S. G. Hooker; and (far right) Sir Frank Whittle, who was also visiting Bristol Siddeley.

propulsion for supersonic aircraft. According to Mr. Alford about 90% of all Mach 2 flying has been done in aircraft powered by the J79 variable stator engine. He will describe those features important for supersonic flight and make an examination of inlet-duct/engine-airflow matching over the flight envelope. The operating flexibility of the variable-stator engine will be analysed in regard to meeting requirements for adequate stall margin at low and high corrected engine speeds.

Mr. Alford will evaluate aircraft performance improvement resulting from use of the variable-geometry convergent-divergent jet nozzle. He will describe development of the propulsion system for the supersonic B-58 Hustler. Future prospects will be examined with particular reference to fan engine configurations which appear promising for supersonic transports in the speed range of Mach 2.2-3.0.

Air Cushions for Landing Gear

THOUGH the potentialities of the Hovercraft appear to lie mostly in the development of waterborne traffic, initial experiments with these air-cushion craft, as conceived by Mr. C. S. Cockerell, have lain with the aircraft industry. It seems likely, also, that manufacturers with aircraft-constructing experience are more likely to appreciate the possibilities of such unorthodox vehicles than those concerned with the ancient traditions of building ships. For these reasons, though it is well understood that the Hovercraft is essentially a land- or



This illustration from Mr. Cockerell's lecture gives an informative analysis of various forms of transport in terms of speed and power and shows the place of the cushion-craft.

water-supported craft, there is justification for reporting on certain aspects of the paper which Mr. Cockerell read before the Royal Society of Arts in London on Apr. 6. His talk was accompanied by an excellent colour film of the Saunders-Roe-built SR-N1, showing the facility with which the craft could cross a road and beach on its way to and from the sea. This is the vehicle in which the propulsive air ducts are to be supplemented by a Marboré turbojet supplied by the Blackburn Company.

Of special interest from the air transport aspect was a reference to air-bearing railcars, as proposed by Fords in the United States, a cushion-supported craft with a very thin layer of air operating on a smooth steel rail. Such craft would probably yield the best propulsive efficiency of any vehicle known, at the cost of an expensive overhead mono-rail. So it could be that they might be used to link airports with cities.

Also of aeronautical import was the reference to the cushion-cum-aircraft combination which Mr. Frost of Avro-Canada has been working on for some years. At present, aircraft use wheels for landing and for take-off. It is interesting to speculate what the effect would be on the performance, and more particularly on the maximum practicable size, if a cushion landing-system were substituted, the aircraft remaining partially cushion-borne up to speeds of perhaps 200 knots.

Mr. Cockerell suggested that a cushion landing-system and an atomic power unit might eventually make practicable a really heavy inter-continental air-freighter.

Great Expectations at Kidlington

SHACKLETON'S sales week-end at Kidlington on May 6-8, which has come to be regarded very much as a light aeroplane "Farnborough," promises some particularly interesting types this year. Positive bookings have already been received for 35 aircraft for the new-types park, and these include British, American, French, German, Italian and Polish machines.

Auster will be showing the new Lycoming-engined D.4 and Autocar D.6, while the full Cessna range, including the new 210, and the well-known Piper types, plus the new Aztec and Pawnee, will be demonstrated by Airwork Services and Vigors Aviation, respectively. Other American newcomers will include the Bellanca 260, while from France are expected the four-seat Jodel Mousquetaire, as well as the Jodel D.117 two-seater, exhibited by Rollasons.

The now-familiar Piaggio P.166 will be flown alongside other aircraft from Italy such as the Falco and the F.15 Picchio. Particularly interesting visitors will be the Polish PZL-101 crop-sprayer and the PZL-102 KoS light tourer.

Hallé and Farewell

AT the R.A.F. Anniversary Concert at the Royal Festival Hall on the evening of Apr. 6 Sir John Barbirolli made an effective speech of farewell to Wg. Cdr. A. E. Sims, O.B.E., on his retirement from the Service. Wg. Cdr. Sims has been a popular figure at Anniversary concerts for some years, and has been Director of Music of the Central Band of the R.A.F. since 1946.

Indicating the members of the band Sir John stated that no more fitting tribute could be made to their Director than "that glorious band of the R.A.F. before your eyes—and soon to be in your ears." He went on to state that he used the word "glorious" advisedly as that was the sort of sound they made, which was later proved by the easy expertise of the trombone sextette.

The concert, given by the Hallé Orchestra, must have had a strong nostalgic flavour for Wg. Cdr. Sims—the first item, as last year, was a Fantasia on the Air Force march and the programme included Walton's Spitfire Prelude and Fugue, concluding with the ever-popular "1812" Overture. Sir John paid special tribute to the playing of Denis Matthews in Schumann's Piano Concerto in A minor.

The Festival Hall was packed, as is usual on these occasions, which are organized in aid of the R.A.F. Benevolent Fund. Many distinguished guests were present.—V.M.

A Multi-purpose Aviation Club

RECENTLY, at breakfast at a certain club facing Green Park, a middle-aged gentleman got talking and in under two minutes had turned the conversation to lighter-than-air. A few minutes later another member turned the talk to gliding. Whereon a third brought out his pet idea of a flying club where all forms of aeronautics were carried on—gliding, ballooning, light aeroplanes and small airships for a start. On each day members would practise whichever forms of flying were best suited to the weather. But some cynic said that the difficulty would be that on a cracking cross-country soaring day there would be a run on the sailplanes, while on a stable day, with light winds, everybody would want to go up in the airship. Perhaps if a very small and expensive club were formed it would avoid large-scale frustration.

Retiring from D.H.

AFTER more than 31 years in the de Havilland organization Mr. C. S. Thom—for many years sales director of the Aircraft Co.—is retiring. Since 1958 he has been executive assistant of the parent company, de Havilland Holdings, Ltd.

Born in 1899, Mr. Thom served with the R.F.C. during the First World War and subsequently spent 10 years with the Aviation Department of Shell-Mex, Ltd. He then joined the de Havilland sales department at Stag Lane in 1928, and during the '30s when the light aircraft business was thriving in this country he made extensive sales tours abroad. He was appointed sales manager of the company in 1936.

When War broke out in 1939 he was closely concerned with the setting up of de Havilland's repair organization at Witney and later inaugurated the Second Aircraft Group at Leavesden—he was responsible for the building of the factory and its management—together with the subsidiary units. Towards the end of the War he took over the contract administration for D.H. manufacture and repair of aircraft, engines and propellers.

In 1944 when the Engine and Propeller Divisions were in process of being re-formed as separate companies, Mr. Thom resumed his position as sales manager for aircraft. He was appointed to the board of the company in 1951 as sales director, a post he held until 1958 when he became associated with the affairs of the parent company.

Aviation News in General

CANADIAN NEWS.—There have been exploratory talks between Canada and the United States for the supply of about 60 McDonnell F-101 Voodoo all-weather fighters to replace the CF-100s in service with nine R.C.A.F. squadrons. The Canadian Army is also reported to require about 40 Vertol 107s, or similar types, and 40 or so Bell helicopters. The R.C.A.F. has ordered two Vertol V-44s to supplement its Vertol H-21s.

MIRAGE IV ORDER.—The French Government has announced that it has ordered the construction of 50 Dassault Mirage IVs. Production aircraft are to be powered by two developed SNECMA Atar 9s with afterburners and will have a take-off weight of approximately 105,000 lb. Delivery is expected in 1963.

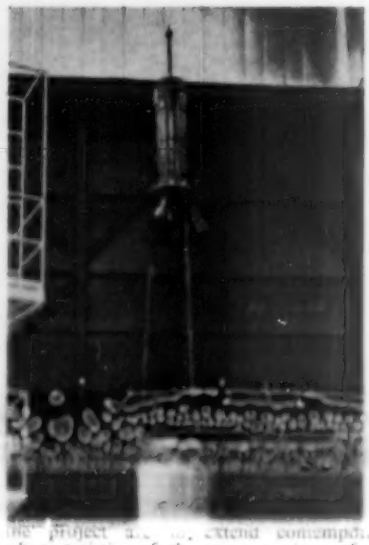
RB.163.—The first run of the Rolls-Royce RB.163 engine will be in October. The [illegible] will power the Airco [illegible]

[illegible] developed a new variant of its Gazelle free-turbine engine, known as the [illegible]

A.T.C. by DME.—The U.S. Federal Aviation Agency is making use of distance-measuring equipment to reduce aircraft separation along domestic airways. Aircraft which are DME-equipped can be longitudinally separated by distance and not by the usual 10-minute time-interval. With turbojets, the new system may mean a reduction from 100 to 20 miles in en-route spacing. Some 80 VORs in the U.S.A. have now been commissioned as VORTAC (VOR/DME) stations.

GLIDE PATH INDICATORS.—Five visual glide [illegible]n indicator lighting systems are being evaluated by the F.A.A. at Atlantic Ci[illegible]. They include the R.A.E. Calvert system, the U.S. Navy mirror system (based on the British invention), the Australian Lumming-Lane system, the U.S.A.F. "Meat-ball" system and the Westinghouse [illegible] system.

[illegible] to be [illegible]ced by the F.A.A. Developed for the U.S.A.F., it provides coverage over [illegible] radius of 120 nautical miles [illegible]



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More About Supersonic Engines

A DISTINGUISHED powerplant specialist from America, Mr. J. S. Alford, A.F.R.Ae.S., design engineer of the General Electric Company, is visiting this country next month to give the second Halford Memorial Lecture, before the Hatfield Branch of the Royal Aeronautical Society. He has chosen for his subject a topic of widespread interest at the present time—powerplants for supersonic transport—and his lecture promises to be well worth hearing. It is to be on May 11 at [illegible] in the Central Hall of Hatfield Technical College.

A synopsis sent to us by the R.Ae.S. indicates that the lecturer proposes to analyse operating experience with air-breathing

SEEING BRISTOL SIDDELEY.—A party from the German Dornier Werke, [illegible] a visit to Bristol Siddeley Engines recently. Left to right are: Dr. Jaegar, Dornier chief designer; Mr. N. R. Quinn; Mr. A. C. Pitt; Dr. P. Dornier; Dr. S. G. Hooker; and (far right) Sir Frank Whittle, who was also visiting Bristol Siddeley.

THE AEROPLANE and ASTRONAUTICS 448 APRIL 15, 1960

Aviation News in General

Commercial Aviation Affairs

F-27 ORDERS.—The All Nippon Airways order for three Fokker F-27As (our issue for Mar. 18) has been confirmed. They will be 40-seaters with Dart RDa.7 engines, and will be delivered in the spring of next year. Braathens S.A.F.E. has ordered a third F-27.

F.A.A. NEWS.—In 1959, the F.A.A. certificated three new jet airliners, 17 business and general aviation aircraft and five helicopters. Its inspection pilots flew more than 40,000 hr. to check the accuracy of navigational aids. Air traffic control centres handled 9,589,000 IFR movements along 220,000 miles of Federal airways; F.A.A. towers handled 26,866,000 airport movements and Agency approach facilities controlled 1,055,000 instrument approaches.

DC-8 DELIVERED.—The first Douglas DC-8 Srs.30 for S.A.S. [illegible] on Apr. 6 [illegible] seats 28 first-class and 92 economy-class [illegible]

DUBLIN TO LEEDS.—Aer Lingus inaugurated their Dublin-Leeds service on Apr. 2, using Dakotas. Next year, when B.K.S. introduces Avro 748s, Aer Lingus is expected to put F-27s on to this route.

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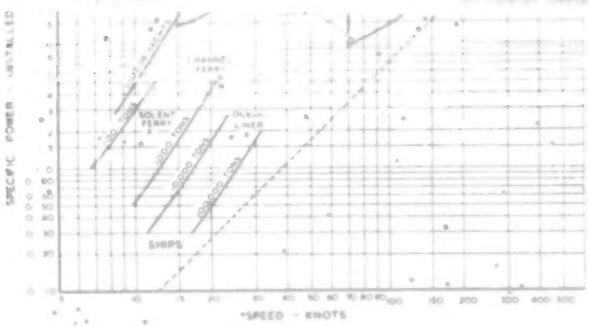
ARGOSY SUPPORT.—A.W.A. is to set up a spares store in Beirut for the Argosy, to support the aircraft used by Trans Arabia Airways and any other Argosy users in the area. At a recent meeting, 18 sub-contractors discussed after-sales service and provisioning for Trans Arabia; almost all the components were undertaken to provide 24-hour [illegible]

[illegible] PROPOSED.—The F.A.A. has proposed that all turbine-powered aircraft should carry flight [illegible]

BIRMINGHAM AIRPORT.—The arrangements between the Ministry of Aviation and the Birmingham Corporation over Elmdon are that the latter now has the responsibility for running the airport, but the Ministry will provide staff and equipment for technical and navigational services and will contribute 60% of the cost of future approved capital works and those since Apr. 1, 1956. The agreement is for 21 years and is generally similar to that reached for Manchester Airport, Ringway.

SIMULATOR HOURS.—B.O.A.C. is obtaining 16 hours a day utilisation from its Boeing 707 simulator on six days out of eight. The Link moving-base simulator has been installed at the Central Training Unit, Cranebank (on the edge of London Airport), and to date a training nucleus of 22 pilots and six engineer officers have completed the three-week course.

[illegible] at Lucerne from May 7 to 10. About 100 representatives of [illegible] member airlines, [illegible] attend.



This illustration from Mr. Cockerell's lecture gives an informative analysis of various forms of transport in terms of speed and power and shows the place of the cushion-craft.

water-supported craft, there is justification for reporting on certain aspects of the paper which Mr. Cockerell read before the Royal Society of Arts in London on Apr. 6. His talk was accompanied by an excellent colour film of the Saunders-Roe-built SR-N1, showing the facility with which the craft could cross a road and beach on its way to and from the sea. This is the vehicle in which the propulsive air ducts are to be supplemented by a Marboré turbojet supplied by the Blackburn Company.

Of special interest from the air transport aspect was a reference to air-bearing railcars, as proposed by Fords in the United States, a cushion-supported craft with a very thin layer of air operating on a smooth steel rail. Such craft would probably yield the best propulsive efficiency of any vehicle known, at the cost of an expensive overhead mono-rail. So it could be that they might be used to link airports with cities.

Also of aeronautical import was the reference to the cushion-cum-aircraft combination which Mr. Frost of Avro-Canada has been working on for some years. At present, aircraft use [illegible] for landing and for take-off. It is interesting to speculate what the effect would be on the performance, and more particularly on the maximum practicable size, if a cushion landing-system were substituted, the aircraft remaining partially cushion-borne up to speeds of perhaps 200 knots.

Mr. Cockerell suggested that a cushion landing-system and an atomic power unit might eventually make practicable a really heavy inter-continental air-freighter.

[illegible] special tribute to the playing of Denis Matthews in Schumann's Piano Concerto in A minor.

The Festival Hall was packed, as usual on these occasions, which are organized in aid of the R.A.F. Benevolent Fund. Many distinguished guests were present.—V.M.

A Multi-purpose Aviation Club

RECENTLY, at breakfast at a certain club facing Green Park, a middle-aged gentleman got talking and in under two minutes had turned the conversation to lighter-than-air. A few minutes later another member turned the talk to gliding. Whereon a third brought out his pet idea of a flying club where all forms of aeronautics were carried on—gliding, ballooning, light aeroplanes and small airships for a start. On each day members would practise whichever forms of flying were best suited to the weather. But some cynic said that the difficulty would be that on a cracking cross-country soaring day there would be a rush on the sailplanes, while on a stable day, with light winds, everybody would want to go up in the airship. Perhaps if a very small and expensive club were formed it would avoid [illegible] frustration.

Retiring from D.H.

AFTER more than 31 years in the de Havilland organization Mr. C. S. Thom—for many years sales director of the Aircraft Co.—is retiring. Since 1958 he has been executive assistant of the parent company, de Havilland Holdings, Ltd.

Born in 1899, Mr. Thom served with the R.F.C. during the First World War and subsequently spent 10 years with the Aviation Department of Shell-Mex, Ltd. He then joined the de Havilland sales department at Stag Lane in 1928, and during the '30s when the light aircraft business was thriving in this country he made extensive sales tours abroad. He was appointed sales manager of the company in 1936.

When War broke out in 1939 he was closely concerned with the setting up of de Havilland's repair organization at Witney and later inaugurated the Second Aircraft Group at Leavesden—he was responsible for the building of the factory and its management—together with the subsidiary units. Towards the end of the War he took over the contract administration for D.H. manufacture and repair of aircraft, engines and propellers.

In 1944 when the Engine and Propeller Divisions were in process of being re-formed as separate companies, Mr. Thom resumed his position as sales manager for aircraft. He was appointed to the board of the company in 1951 as sales director, a post he held until 1958 when he became associated with the affairs of the parent company.

APRIL 15, 1960 449 THE AEROPLANE and ASTRONAUTICS

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CANADIAN NEWS. — There have been exploratory talks between Canada and the United States for the supply of about 60 McDonnell F-101 Voodoo all-weather fighters to replace the CF-100s in service with nine R.C.A.F. squadrons. The Canadian Army is also reported to require about 40 Vertol 107s, or similar types, and 40 or so Bell helicopters. The R.C.A.F. has ordered two Vertol V-44s to supplement its Vertol H-21s.

MIRAGE IV ORDER.—The French Government has announced that it has ordered the construction of 50 Dassault Mirage IVs. Production aircraft are to be powered by two developed SNECMA Atar 9s with afterburners and will have a take-off weight of approximately 105,000 lb. Delivery is expected in 1963.

RB.163.—The first run of the Rolls-Royce RB.163 engine will be in October. This by-pass engine will power the Airco D.H. 121 airliner for B.E.A.

NEW GAZELLE.—Napier has developed a new variant of its Gazelle free-turbine engine. Known as the Gazelle 512, it will be for helicopters in which all reduction gearing is incorporated in the aircraft installation, and power is taken directly from the free-turbine output shaft. Its maximum power is 1,640 s.h.p. and max. continuous power is 1,275 b.h.p.

MORE Tu-114 RECORDS.—A further series of records for speed with various payloads was set up on Apr. 1 by the Tu-114, according to Moscow Radio. It flew at 532.5 m.p.h. over a 2,000-km. circuit with a 25-tonne payload, setting records at the same time for 1, 2, 5, 10, 15 and 20-tonne payloads over this distance. It had previously set 1,000 km. records with these payloads at 541 m.p.h.

AVON OVERHAUL.—The overhaul life of the Rolls-Royce Avon 524 engines installed in B.O.A.C. Comets has been increased from 1,600 to 1,800 hrs.

SUDAN PEMBROKES.—Two Hunting Pembroke C.55s were recently delivered to the Sudan Air Force at Khartoum, which already had a Pembroke C.51 used by the President.

A.T.C. by DME.—The U.S. Federal Aviation Agency is making use of distance-measuring equipment to reduce aircraft separation along domestic airways. Aircraft which are DME-equipped can be longitudinally separated by distance and not by the usual 10-minute time-interval. With turbojets, the new system may mean a reduction from 100 to 20 miles in en-route spacing. Some 80 VORs in the U.S.A. have now been commissioned as VORTAC (VOR/DME) stations.

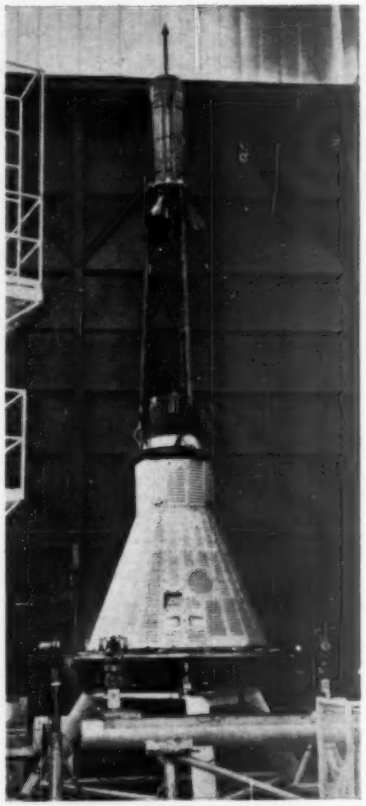
GLIDE PATH INDICATORS.—Five visual glide path indicator lighting systems are being evaluated by the F.A.A. at Atlantic City. They include the R.A.E. Calvert system, the U.S. Navy mirror system (based on the British invention), the Australian Cumming-Lane system, the U.S.A.F. "Meat-ball" system and the Westinghouse tri-colour system.

RADAR EVALUATION. — Bendix AN/FPN-34 (XW-1) surveillance radar is to be evaluated by the F.A.A. Developed for the U.S.A.F., it provides coverage over a radius of 120 naut. miles from the terminal area.

MASEFIELD LECTURE.—The President's address of the Aircraft Recognition Society will be given on Apr. 20 by Mr. P. G. Masefield; his subject will be "Survey of Civil Aviation, 1960." The meeting will be in the R.Ae.S. library, 4 Hamilton Place, W.1, at 19.00 hrs.

SPACE-MAN, 1960.—In a recent TV interview, Dr. Keith Glennan, the NASA administrator, said he was confident that a man would be launched into space this year, to a height of perhaps 120 miles and for about 200 miles downrange from Cape Canaveral. Proposed launching vehicle is the Chrysler Redstone adapted to carry a McDonnell Mercury space-capsule.

FAREWELL SPUTNIK III.—After orbiting the Earth since May 15, 1958, the 26-cwt. "orbital laboratory" Sputnik III is believed to have disintegrated in the atmosphere over Canada on Apr. 6. The satellite completed about 10,050 orbits, travelling 275 million miles.



MAN HIGH.—A prototype McDonnell Mercury ballistic capsule of the type in which a man is expected to travel 120 miles into space during the summer. Note the escape rockets designed to separate the capsule from the launching rocket in emergency.

PROJECT RANGER. — Study contracts for a 300-lb. instrument capsule for hard-landing on the Moon have recently been placed with Hughes Aircraft Co., North American Aviation, Inc., and the Aeronutronic Division of the Ford Motor Co., by the Caltech Jet Propulsion Laboratory.

SKY BOLT COSTS.—Spending on the Douglas Sky Bolt ALBM, including research, development, production and modification to B-52 launching aircraft, may amount to a thousand million dollars over 10 years. First Sky Bolt-armed B-52H squadron is scheduled for 1965, with more than 20 further squadrons to follow.

MORE ATLAS SPENDING.—President Eisenhower has approved increased spending on the Atlas programme raising the production quantity for the 1961 fiscal year (beginning this July) from 40 to 58.

BOMARC CUT.—To achieve increased production of the Atlas ICBM, America is reducing orders for the Bomarc-B SAM and the SAGE electronic system that controls it. The 400-mile range missile has performed erratically in recent tests. Last year, Canada adopted it in place of the Avro CF-105 Arrow supersonic interceptor.

MACH TWO TRAINING.—A six-man Luftwaffe team has begun conversion training at Palmdale on the Lockheed F-104F Starfighter, which is the two-seat version of the Luftwaffe F-104G. After the seven-week course the team will return to Germany to instruct on the 30 F-104Fs to be initially delivered.

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DC-8 DELIVERED.—The first Douglas DC-8 Srs.30 for S.A.S., named "Dan Viking," arrived at Copenhagen on Apr. 4 after a 7 hr. 41 min. flight from New York. Powered by 16,800-lb.s.t. Pratt & Whitney JT4A-9 turbojets, it seats 28 first-class and 92 economy-class passengers.

DAY TRIPS TO CALAIS.—Channel Air Bridge, in conjunction with British Railways, inaugurated rail/air no-passport day trips to Calais on Apr. 10. Tickets for the combined rail and air journey can be bought at Liverpool Street, Fenchurch Street, or seven intermediate stations to Southend, and the journey to Calais takes less than 2 hr. from London. Similar rail-air excursions are available to Ostend and Rotterdam, for which passports are, at present, required.

GERMAN PROJECT.—Hamburger Flugzeugbau is seeking German government backing for the development of its HFB 314 medium range jet transport. The aircraft is designed to carry 78 passengers and to cruise at about 600 m.p.h. over a range of nearly 1,300 miles.

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RECORDING TURBOPROPS.—The F.A.A. has proposed that all turbine-powered aircraft should carry flight-recorders after Sep. 1, 1960. At present, the regulation applies to aircraft operating above 25,000 ft.

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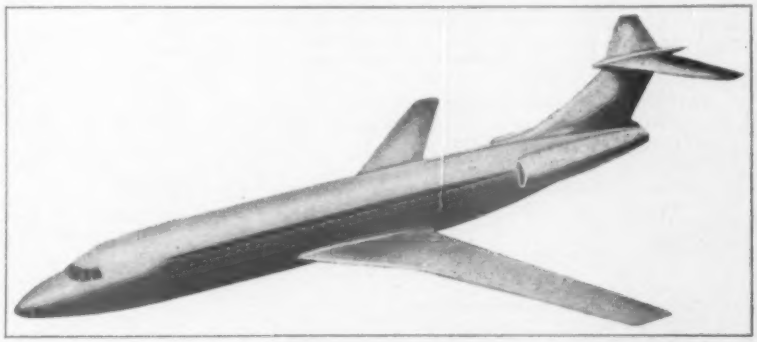
IATA TECHNICAL.—The 13th annual technical conference of IATA will be held at Lucerne from May 2 to 10. About 300 representatives of the 90 member airlines, government agencies, air forces, manufacturers, research establishments and others are expected to attend.



News About People

REDHILL CHANGES.—Dr. Edmund T. Price, B.S., L.H.D., of San Diego, California, has been appointed managing director of Tiltman Langley, Ltd. Until recently Dr. Price was president of Solar Aircraft Co. in San Diego, California; he was appointed chief executive of Tiltman Langley, Ltd., last October.

AIRWORK INSPECTOR.—Mr. L. W. A. Osborne has been appointed chief inspector of Airwork Services at Hurn. He served with Airwork at Heston and Misr-Airwork in Egypt before the War and again from 1939 to 1949.

Mr. L. M. STEWART.—We regret to record the death, at the age of 66, of Lindsay Murray Stewart, who, until his retirement in 1958, was underwriter and manager of Aviation and General Insurance Co., Ltd. Mr. Stewart was the Company's first underwriter and had been associated with it for more than 24 years. He was a founder member of the Air Registration Board. A memorial service was held on Apr. 12 at St. Michael's Church, Cornhill.

M.o.A. RETIREMENT.—Mr. E. Vincent Miller, O.B.E., Divisional Air Traffic Control Officer of Northern Division (Liverpool) retired from Ministry of Aviation service on Mar. 31. Mr. Miller has been with the M.o.A., the M.T.C.A. and M.C.A. for more than 20 years, and has held the Divisional post during the past 10 years.

SILVER CITY ENGINEERING.—Mr. William Kerr has been appointed engineering superintendent of Silver City Airways' Southern Division. He succeeds the late Mr. B. Sparrow.

REPUBLIC APPOINTMENT.—Mr. Eugene W. Murphy has been appointed by Republic Aviation Corpn. as assistant director of European operations and chief of public relations for Europe. As we recorded last week, Republic have acquired a minority interest in Fokker.

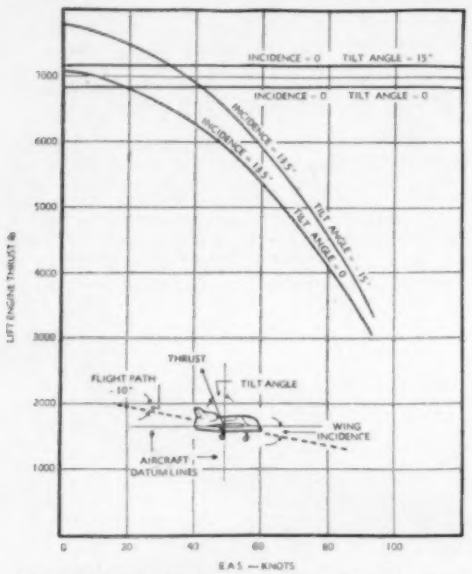
MR. IAN REID.—We regret to record the death, after a short illness, of Mr. Ian Reid, sales manager of Scottish Aviation, Ltd. On a sales promotion tour in the Far East, Mr. Reid died in New Delhi on Apr. 5.

PRESIDENT'S PEMBROKE.—In the green, yellow and blue markings of the Sudan Air Force, this Pembroke C.55 is seen at Wadi Halfa en route to Khartoum. It is being used for training and for the transport of Government officials, including the President.

Success for the S.C.1 Flat-riser

ON Apr. 6 the Short S.C.1 research aircraft made its first transition from normal wing-borne flight to stationary jet-lift hovering and back again. It was flown at the R.A.E., Bedford, by Tom Brooke-Smith, Short's chief test pilot. This achievement represents the culmination of a test programme dating back to Apr. 2, 1957, when the S.C.1 was first flown as a conventional aircraft.

For the transition flight a conventional take-off was made and the S.C.1 was taken on a circuit of the airfield. At a height of 1,500 ft. and a speed of 160 kt., the four Rolls-Royce RB.108 lift engines were lit and a long decelerating approach was made to the main runway, with lift being progressively transferred from the wing to the jet-lift units. At a height of 100 ft. the aircraft completed its transition and decelerated



TRANSITION.—Relationships between jet-lift engine thrust and forward speed are shown for the S.C.1 at incidences of 0° and 13.5° and three engine tilt angles.

to static hovering flight. After hovering at 20 ft. above the runway intersection, an accelerating transition was made to forward flight and the aircraft landed conventionally. The whole flight lasted about 20 minutes.

The success of this major step in the S.C.1's development programme was greeted with considerable enthusiasm by the

NEW FAIRINGS.—Taken just after the S.C.1's VTOL transition flight, this photograph shows that fairings have been added to the undercarriage legs since the aircraft was demonstrated at Farnborough last September.

entire Short and Harland team stationed at Bedford. As soon as the machine had been brought back to the hangar Tom Brooke-Smith told us that the S.C.1 was extremely easy to handle during vertical take-off and landing, and that the transition had presented no problems. He was obviously well pleased with the craft's performance and clearly convinced that VTOL had come to stay; the aircraft industry, he said, must now get VTO-minded.

He said that the S.C.1 had never been designed to be pleasant to fly as a conventional aircraft; it was intended as a test vehicle. But when hovering it was simpler to fly than any of the helicopters he had experienced. It was very safe; there was three-channel autostabilization on pitch and roll axes.

Lift engines were controlled by the equivalent of a helicopter collective-pitch lever, and a twist-grip on this lever controlled the single forward-thrust RB.108 engine. Tilt of the lift engines was varied by a switch. The Rolls-Royce RB.108 lift and thrust engines had a remarkably rapid response to throttle movement.

Achievement of transition by the S.C.1 marks an important step towards flat-rising jet-lift VTOL aircraft of the type proposed for military rôles by Shorts and Messerschmitt. Although civil applications are likely to be further away, advocates of the Griffith slim-delta transport will be much encouraged by the success of the S.C.1.

TRIUMPHANT PARTY.—The Short contingent at R.A.E. Bedford is seen in front of the S.C.1 after its first transition flight. In the centre (with hands in pockets) is Tom Brooke-Smith, Short's chief test pilot, who flew the S.C.1.

Air Transport

Co-operative Compromise

THE beginning of a new and perhaps happier pattern for British air transport could be seen in the arrangements announced in the House on Apr. 5 by the Minister of Aviation. Not only did he announce, as expected, approval for the IATA fares and new low coach fares for the B.O.A.C. cabotage routes to points in Africa, the Caribbean area and the Far East, but he also explained that British independent operators would be allowed their share of the traffic.

Although the scheme does not yet include arrangements for traffic-sharing on domestic or European routes (apart from services to Malta and Gibraltar), it resembles that forecast in our issue of Feb. 5, p. 156. British United Airways (the name for the recently merged Airwork and Hunting-Clan groups) will share with B.O.A.C. the "economy and third class" (or low-fare tourist and colonial coach class) services to and from East and Central Africa; and Eagle Airways (in which Cunard are acquiring a majority interest) will be able to operate services of all classes between the U.K. and Bermuda and the Bahamas.

All of which is as it should be, since Airwork and Hunting-Clan pioneered colonial coach services to and from the African territories and Eagle has pioneered British independent operations between Bermuda and the North American mainland and has been actively interested in low-fare, long-haul expansions of these services.

In Europe, Skyways and British United will share with B.E.A. the services to and from Malta and Gibraltar respectively. On the Gibraltar service British United will use Viscounts for the first time, while B.E.A. will, in due course, use Vanguards. A mid-week night return fare of £30 10s. has already been announced. The agreement comes into force on Apr. 28. Skyways, using L-749A Constellations, will be operating once weekly to Malta, via Tunis, from Apr. 19 and twice weekly from May 17.

The agreements on other routes will be applicable from Oct. 1—the date on which the majority of the new IATA fares also come into force.

An interesting point in these agreements is that they have apparently been reached between the Corporations and the independents themselves. The Minister may or may not have had his shot-gun, ready cocked, behind them before the marriage ceremonies—but the fact that agreements of this kind were possible is sufficiently significant. Certainly the new arrangements will simplify the work of the A.T.A.C. and the Air Transport Licensing Board. It remains to be seen whether similar deals will be made for sharing traffic on domestic and European services.

There may, initially, be some confusion over the new names for the different classes. The word "economy" will apply to the lower-fare services which are at present known as "tourist," and the standards of cabin service will be similar, with the same 44-lb. free baggage allowance.

The lowest fare services, generally known as colonial coach services, will in future be called "coach class" except on the African routes, where they will be known as "third class." The fares will, however, be lower than those applied to the present colonial coach services and will be 25-30% below current tourist rates. They will include soft drinks and hot beverages, and packaged meals will be on sale; the free baggage allowance will be 33 lb. There will also be special inclusive-tour and seasonal student-rate fares at still lower figures.

The lowest fares will only be available to residents of the U.K. or British cabotage areas and for journeys between these territories. The B.O.A.C./British United services will be operated jointly with East African and Central African Airways, presumably on an equal-capacity basis, although the traffic-sharing and frequency arrangements are still being worked out. The Eagle services to Bermuda and the Bahamas will be operated "in co-operation" with those of B.O.A.C. and there appears to be no traffic-sharing plan.

The turbojet/propeller differential question applies on the cabotage services only to the extent that, where applicable, B.O.A.C. will fly the first and economy (ex-tourist) passengers in Comet 4s, whereas the new third-class services will be operated with Britannias.

At the fares to be charged it seems that third-class frequencies will need to be low enough to guarantee very high load factors. The V.L.F. applications by Eagle and Hunting-Clan have now, as a matter of course, been withdrawn.

SOME CABOTAGE FARES COMPARED (ex LONDON)

	Coach and Third Class (Return)	Economy (Return)	Present Tourist Fares (Return)
	£ s.	£ s.	£ s.
Africa			
Nairobi	165 12	196 4	234 0
Salisbury	185 8	221 8	264 12
Asia			
Singapore	273 12	327 12	363 12
Hong Kong	311 8	374 8	415 16
Caribbean Area			
Bermuda	153 0	180 0	218 13
Montego Bay (Jamaica)	176 8	212 5	252 15
Nassau (Bahamas) ..	162 0	189 15	231 10
Trinidad	198 0	242 8	283 10

British United Airways

THE name adopted by Airwork and Hunting-Clan, following the recent merging of their air transport interests, is, as expected, British United Airways. Details of the merger were given in our issue for Mar. 11.

Announcing the adoption of the new name, the company points out that it will be some time before all the Group's aircraft are flying under this name and in the same colours. It is likely that the Channel Air Bridge car ferry operation from Southend will continue under its present name as a division of the new company. The helicopter operations by Fison-Airwork and Bristow Helicopters will gradually be integrated into the new company. Other names which will disappear are Air Charter, Morton, Olley and Transair.

Mr. M. D. N. Wyatt, formerly chairman and managing director of Airwork, has been appointed chairman of British United, but details of other appointments have not yet been made known. We understand that Mr. Maurice H. Curtis and Capt. L. B. Greensted, respectively managing director and operations director of Hunting-Clan Air Transport, have resigned and will not be associated with British United. Of the other Hunting-Clan directors, Mr. P. Ll. Hunting (chairman) and the Hon. A. Cayzer, at least, seem likely to join the new board.

As part of the general fleet reorganization, Transair (a member of the former Airwork Group) is withdrawing its Dakotas in favour of Viscounts. As a consequence, four captains and nine co-pilots have been declared redundant. This move brought a protest last week from BALPA, which said that the "last in, first out" principle, agreed by the National Joint Council, was not being followed.

Postscript to the Decca Reports

FOLLOWING the publication of the Federal Aviation Agency reports on Decca (see our issues of Jan. 15, p. 62 and Mar. 4, p. 276), the Ministry of Aviation has expressed its views in a letter to the secretary-general of ICAO.

After praising the objective evaluation of the "Helicopter Operations Program, Phase 1" report and noting with encouragement the continuation of evaluation during the Phase 2 IFR programme, the Ministry's letter goes on to say:—

"It is with regret that the United Kingdom feels bound to observe that the supplementary report, 'Operational Test of Mark 10 Decca System in C-131 Fixed-Wing Airplane,' suffers by comparison with the principal document and cannot be accepted in the same category of objective reporting. Experience of system evaluation extending over many years strengthens the belief that the approach to the subject has in this case been hasty and ill-conceived. The United Kingdom is accordingly unwilling to allow the issue of the Supplementary Report at the present time and in the present circumstances to pass without comment, and makes the following observations in the true spirit of international co-operation.

"The expressed purpose of the trials dealt with in this report was 'not to conduct a precise programme but rather to assess, through pilot experience and opinion, the extent to which the automated Mark 10 components might facilitate air navigation in typical United States air traffic control environments.' If meaningful results are to be obtained from a subjective trial of this kind it

Air Transport . . . .

is essential to take great care to ensure that neither the trial conditions nor the method of assessment used can introduce large biasing factors. Unfortunately no attempt seems to have been made in these trials to guard against the presence of such factors or to make allowance for them.

"Serious biasing factors present in these trials were:—

"(i) A large proportion (approximately half) of the route mileage flown was in the areas of coverage and accuracy where the Decca Mark 10 system is not, and has not been claimed to be, entirely satisfactory for navigation of all ATC procedures.

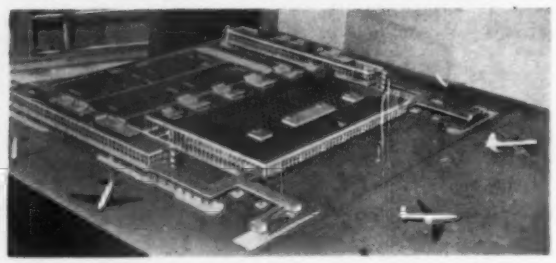
"(ii) The type of questionnaire used does not permit statistical examination because there is no discrimination between operationally significant and insignificant faults.

"(iii) The tests were conducted on low power chains in conditions of relatively high background noise level. The radiated power was less than normally provided from other operational chains and appears to have been inadequate for the purpose of the trials.

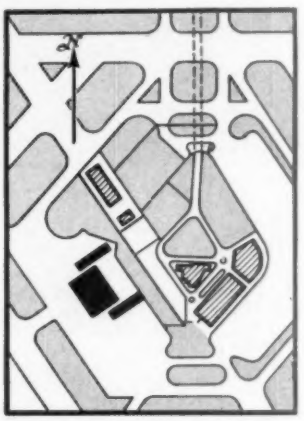
"(iv) The design of the flight log charts was in some instances unsuitable for the declared purpose of the trials.

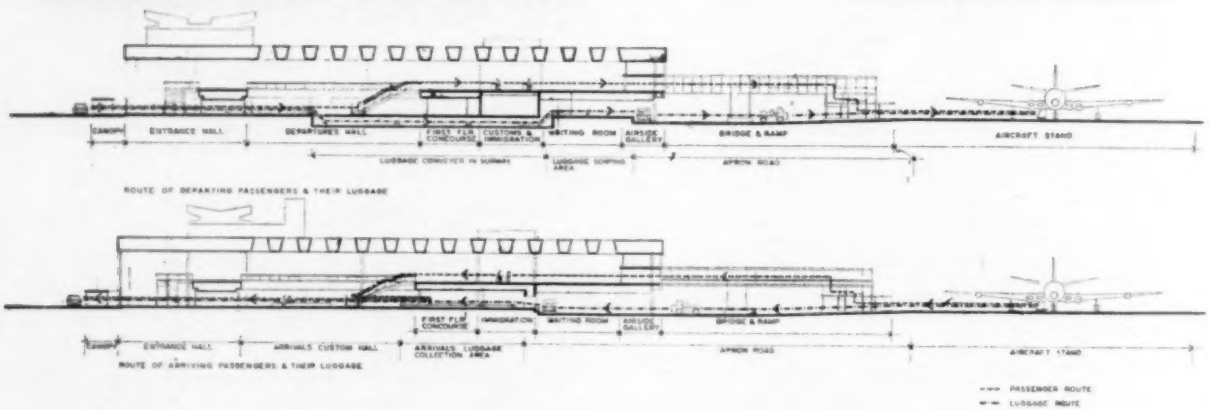
"There is no evidence in the report that these serious biasing factors have been given due weight, either in the design of the pilots' questionnaire or in the analysis of results. In these circumstances, it is clearly unwise to draw firm conclusions. The fact that, despite these shortcomings, an attempt was made to draw conclusions casts serious doubts on the value of the report. . . ."

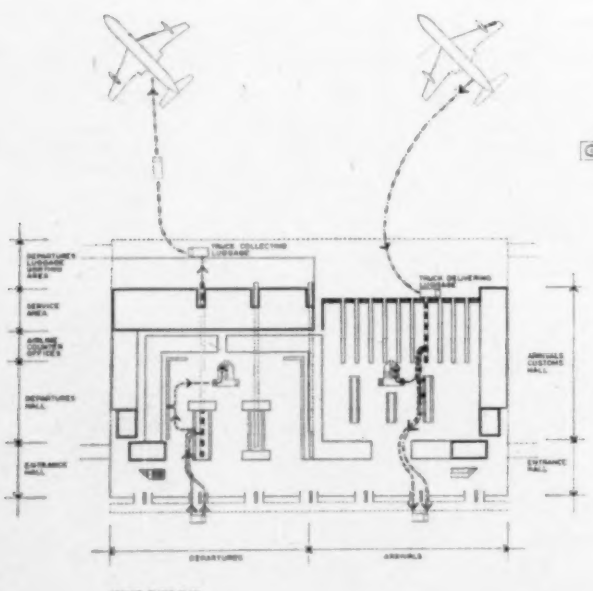
L.A.P.'s Long-haul Terminal Layout

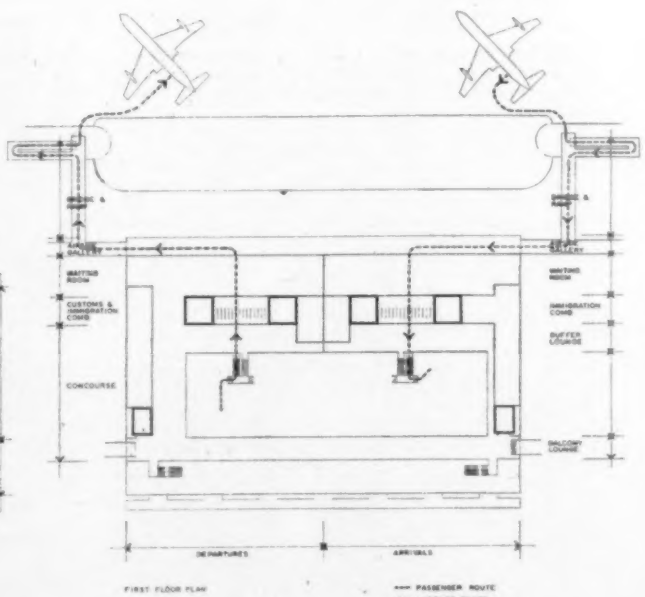


The main drawings in this group of pictures show the traffic flows through the new long-haul terminal, which will be divided as in plan for incoming and outgoing traffic. The small plan shows the position of the new buildings (black) in relation to the other features of the central area. The architect is Frederick Gibberd.









EVEN BETTER THAN PROMISED

Before the first Vanguard goes into scheduled service, and little more than a year after the first flight tests, development has made possible dramatic increases in maximum operating weights. Details are given in the table below. These improvements have been achieved for an empty weight increase of only 600 lb, and allow a margin of 1,600 lb for future development, equipment changes or customers' special requirements.

VANGUARD PAYLOAD UP BY 8,000 lb

	Original specification	New specification	Increase
GROSS TAKE-OFF WEIGHT	141,000 lb	146,500 lb	**5,500 lb**
MAX. LANDING WEIGHT	121,000 lb	130,500 lb	**9,500 lb**
MAX. 'ZERO FUEL' WEIGHT	112,500 lb	122,500 lb	**10,000 lb**
MAX. PAYLOAD	29,000 lb	37,000 lb	**8,000 lb**

The Vanguard can now carry 139 economy-class passengers plus over 8,000 lb freight. Without intermediate refuelling, 100-passenger payloads can be carried over such important consecutive sectors as London–Frankfurt–Vienna–Prague.

Operators with profit in mind and air travel for all in view, will find the Vanguard is more attractive than ever.

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE PROPELLER-TURBINE ENGINES

The airliner with the biggest profit potential ever offered to the operator

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

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SURVIVAL DEPENDS ON VERSATILITY

IN DEFENCE AGAINST AIR ATTACK AS IN NATURE

Not only in Natural History is versatility of life-or-death importance. It is equally important in the field of defence against air attack—and here a vital weapon is the guided missile.

Missile systems can either be operationally static—permanently sited on fixed concrete emplacements—or, as in the English Electric Thunderbird, they can be operationally mobile—able to be taken across country in standard military vehicles and redeployed in a few hours.

The important thing is that the mobile missile—Thunderbird—can also operate as a static one; it can stay put on a chosen site for as long as that site continues to be the most suitable one.

But if the unexpected happens—and in war it always does—Thunderbird, unlike a static system, can be away and in action again to meet a new threat overnight. It is operationally flexible.

EVOLUTION CONTINUES

Thunderbird is now in service with the Army, who rely on its inherent mobility for quick switches in planning, for easy resiting of defences and for the basic flexibility which alone can solve the ever-changing problems of air defence.

An even more advanced version of Thunderbird is well under way. It will give longer range and better performance against low-level attack while retaining full mobility and air-transportability.

Evolution goes on—to give still more versatility to the Thunderbird weapon system upon which our survival may depend.

'ENGLISH ELECTRIC' THUNDERBIRD

ENGLISH ELECTRIC AVIATION LIMITED · *GUIDED WEAPONS DIVISION* · **LUTON** · **STEVENAGE** · **WOOMERA**

Thunks for the Memory

WITH a wan smile (the P.R. chaps must have their fling) I see from time to time that so-and-so has set up a new record for a commercial flight between London and New York. I just wonder at what time they actually arrived. Were they really 40 minutes ahead of the 16.45 New York arrival time suggested in the timetable, or did the hypothetical record-flying passenger have a journey more like that of real passenger B-S?

* * *

Report at 09.15 (sharp) with coach-travelling minority group at Victoria Air Terminal. Victoria is rather Georgian—not a bit like all that gloss in the Cromwell Road; we feel like proper travellers instead of 20th century European commuters.

Coach still has not left at 09.45. Mentally step up "London to New York in 7 hours 35 minutes" by 20 minutes, when a sought-after and apologizing Mr. X arrives at 10.05, having forgotten to pay his $15 surcharge. (The Messrs. X must play hell with airline planners' nerves.)

At 10.25 we are on the Cromwell Road extension; the coach driver is winning.

Quickest passage yet of London Airport formalities. At 10.50 we follow the blue lights in a lightning Conga through the building to a pair of yellow buses and shoot out on to the apron. I am getting excited at the prospect of an 11 o'clock take-off after all when we pull up beside a very large aeroplane with a small engineer standing beside it. The engineer beams helpfully and says there will be a delay and will the stewardess please take us back to the lounge for half an hour. Incurable optimists, we start doing sums in the head again: 7 hours 35 minutes plus 20 minutes for Mr. X, minus 20 minutes for heroic coach driver, plus half an hour for the engineer makes 8 hours 5 minutes.

Loudspeakers explain that a jet tail-pipe is slightly faulty; American passenger reading *Time* announces that air fares are to be cut by 17% in April, and thinks we may yet make a profit out of the delay. The loudspeaker apparently overhears this remark, for it offers us the hospitality of the bar.

At 12.20 we start again. Inside of 707 is rather fun: a kind of cross between Bond Street Underground Station and the Curzon Cinema, all deep cushions and Muzak, and the delicious anticipation of going to stay in a hotel you know you can't afford. The Purser (we note the big-ship touch) introduces us to the Purserette (we come ashore again rapidly). Life jacket and oxygen mask demonstration. A not very scientifically minded lady near me thinks it would dangerous to have all that oxygen about in an emergency.

There is a muttering noise from the two engines I can see hanging on their stalks and looking like multiple cigarette holders from a joke store. The Boeing has more of everything—including a miniature field of tank traps on top of the wing, made from silver railway tickets standing on edge. We do not hang about. Gloomy experts have informed me that we shall be past the last intersection on the runway before the wheels leave the ground. This proves to be nonsense. Then I see that the last intersection is the one by the boundary fence.

The experts tell me that we consume two gallons of fuel a second during take-off; most of this trails in a black stream behind us. At 1,000 ft. (my estimate) we level off slightly and the engines stop. I am assailed by doubt. Should we level off? We fly, sinking, in a climbing attitude over Buckinghamshire or somewhere. Morale sinks—accelerated by a burst of white smoke (steam? oil? oxygen?) from the engine I am watching for the pilot. Somewhere around Salisbury the pilot remembers and turns the engines on again.

A 25-page volume, generously entitled "Your Jet Clipper," tells me in retrospect not to worry about Thunks and Rumbles. I have been thunking too hard about Buckinghamshire to worry about Rumbles. At 13.00 we are over the Bristol Channel.

First American dry martini served at 13.15. Ten minutes later I could look a thumble in the face without flinching. America is wonderful. Ireland is wonderful (over Shannon at 13.25), with a white crust of surf all along the edge. By the map we had travelled 381 miles in one hour, but in "My Jet Clipper" we are almost there, with air rumbling in the wheel compartment again. I learn that the wheels outnumber those on conventional aeroplanes by two to one.

It is now (at 14.00) five hours 35 minutes later than it was 35 minutes ago and my arithmetic is thrown into further disorder by the Purser, who announces that we have been able to skip Gander but must now stop to refuel at Boston.

Corker of a headwind. E.T.A. Boston now 15.20.

At 15.30 we Rungle into Boston. At 16.05 we Thump into air again. Full sound effects for arrival at Idlewild at 16.45.

If you add up 20 minutes for Mr. X, less 20 minutes for the coach driver, plus an hour-and-a-half for the tail pipes and, say, 45 minutes for stopping at Boston and subtract five hours for the sun, we flew the Atlantic in eight-and-a-half hours. So who cares about records, anyway? I am inclined to agree with the President of PanAm. He says: "Mass travel by air—made possible in the jet age—may prove to be more significant to World destiny than the atom bomb."

After a couple of those dry martinis you don't even *care* about World destiny.—RICHARD BENSTED-SMITH.

Selling at a Loss

THE annual reports of the Boeing Airplane Co. and Lockheed Aircraft Corporation for the year 1959, which reached us recently, indicate that production of the 707/720 series and the Electra continued at a loss during the year. Both company presidents, in their reports to stockholders, stress the difficulties in selling commercial aircraft and the rising cost of production.

Net earnings by Lockheed in 1959 were at the rate of 0.66 cents per dollar of sales, the lowest return for 11 years, although sales exceeded $1,000m. for the first time. Commercial aircraft, spares and services represented, at $271.7 million, 21% of the sales total, including 107 Electras delivered to 13 customers. Production costs on the Electra are amortized on the basis of orders received by the end of each year. On this basis, the loss on Electras and spares in 1959 was $9,613,000. Electra costs charged against earnings during the past five years—development, production and administrative—have totalled $50,800,000.

The Electra, says the report "met unexpected airline financing problems, rising costs, and foreign competition." In 1959, orders received "were less than anticipated." The report goes on: "We presently are negotiating for orders which, if signed in 1960, will enable us to record profits on the Electra. However, the competitive situation is complex and difficult to analyse. If, as is possible, very few orders materialize in 1960, we will record a loss on this year."

The Lockheed report also warns its readers about the dangers to manufacturers of trade-in deals. The company, it says, already has several used transports and is committed to acquire others in connection with present Electra orders. Some capital may be tied up in the efforts to obtain the best selling prices for these trade-ins.

At the end of 1959 the commercial back-log was 13% of a $1,155 million total, and included undelivered Electras and firm orders for 21 JetStars (another 29 delivery positions have been reserved). Among the assets on the balance sheet are the development costs on transport aircraft initiated as specific military projects, for which "it is anticipated that both military and commercial contracts will be obtained. . . ." These items include $30.5 million relating to the JetStar, $2.5 million in respect of a proposed supersonic transport and $1.5 million for the Super Hercules.

Net earnings by Boeing in 1959 were at the rate of 0.77 cents per dollar of sales and $1.65 per share of common stock. The total sales value, at $1,612 million, was slightly below the 1958 record figure. Commercial aircraft, spares and services were worth $504 million, including 76 Boeing 707s delivered. Commercial aircraft costs charged to earnings during the year were $58 million, related to research, development, administrative and general expenses.

Substantial additional costs against the overall commercial programme have been caused by the engineering, tooling and manufacturing process changes necessary for the design improvements which have been developed over the past two years and are now being incorporated in all 707s in service and production. These extra costs reduced the earnings in the last quarter of 1959 and will also affect the 1960 earnings.

While public acceptance of the Boeing jet transports is enthusiastic, says the report, "the company has sustained a very substantial loss on the orders to date. . . . Further, competition for additional orders for jet transports has become increasingly keen. It is not limited to performance of the respective aircraft and basic price, but has been extended to include as well the financing of equipment purchases, the taking of used equipment as trade-ins, and in some instances a combination of the two."

Included in Boeing's $2,000 million back-log at Dec. 31, 1959, were orders for 68 Model 707s and 46 Model 720s, which, with turbofan engine conversion kits and spares, had a total value of $585 million. Orders for seven more 707s and 10 more 720s have been announced since the end of the year.

Air Transport in Brazil

by Neil A. Macdougall, B.A.Sc., P.Eng.

VARIG, Brazil's oldest carrier, recently inaugurated the only jet service between North America and Brazil. Special interest attaches to this operation because of the use of a twin-engined jet for an intercontinental service over difficult terrain. Varig, which has two Caravelles and options on three more, is the only operator of this aircraft in the Western Hemisphere.

During a recent trip to South America, I flew down by Super Constellation from New York and returned by Caravelle. The 16,500-mile trip also provided an opportunity to study internal operations in Brazil, a country like Canada in many ways.

Varig's Caravelles were purchased for domestic operations, but the Government feared the resulting demands from other Brazilian carriers for much-needed foreign exchange. Thus Varig has been forced to use them internationally, on uneconomically long stages. The exchange problem does not come up here, as the other Brazilian international lines have already ordered jets.

Designed as a medium-stage aircraft, the Caravelle can carry 64 first-class passengers over 1,380 nautical miles. On the New York-Rio de Janeiro run, some stages are 1,520 miles, although three stops are made: at Belém, near the mouth of the muddy Amazon, Trinidad and Nassau (for refuelling only).

At a full load of 99,210 lb. the Caravelle needs a 6,560-ft. runway at 30° C. and sea level. This is a modest figure for a jet, but the runways at both São Paulo and Belém are shorter. Moreover, temperatures at Belém average 93° to 97° F. year-round. At noon, the Equatorial sun felt like a giant pushing his hand through my forehead. Loads are further limited by the distance (290 miles) of the only alternate field, São Luíz. Alternates suitable for jets are uncommon, so the big jets will need large fuel reserves.

All this is sad news for the traffic department. On the critical Rio to Belém stage only 36 passengers can be carried. This is great for the passengers, however, who can lounge in their seats and be pampered by the crew of nine. The seat pitch is so great (54 in.) that even a six-footer cannot touch the seat ahead with his feet.

The route to Rio passes over vast expanses of unexplored and unpopulated land, with a corresponding lack of radio aids. (This lack may provide the explanation for the U.S. Army Twin Bonanza which I saw in Arctic camouflage near the Equator.) Loran is available from Carolina in northern Brazil, northwards, but non-directional beacons are the exclusive aid elsewhere. Airline executives said the Government was aware of the need, but lacked the necessary foreign exchange.

Brazil's first radio range (a VOR—there are no LF ranges) is in experimental operation at Rio de Janeiro, and the first three ILS stations are only now being obtained through American aid. Weather limits are 100 metres cloudbase and 1,000 metres visibility for transport aircraft, which are reduced in the daytime only to 60 metres and 800 metres for four-engined aircraft.

Although Varig alone operates 51 weather and 60 radio stations, there is a lack of dependable information on high-level weather. As a result, pressure-pattern flying is not used, although jet streams of 100 knots are common in southern Brazil. The company will soon operate the first private radiosonde at its Pôrto Alegre headquarters. The Caravelle's AVQ-10 radar and the U.S. weather service fix tropical storms accurately.

The lack of facilities is compensated for by the infrequency with which air space is blocked due to military operations. The Caravelle normally cruises at 320-330 knots T.A.S. at 30,000 ft. A climb-cruise is not used because of the pilots' inexperience with the aircraft; for the Caravelle the loss of economy is small.

A book on Brazil which I read before leaving (not supplied by an airline!) said that a crash in the jungles behind Belém would never be found. It is significant that a major airline now considers it safe to operate a twin-engined airliner over such terrain and the sea. The reliability of civil jet engines has far exceeded expectations—aided, in the Avon's case, by many hours of military operation. Indeed, the American prejudice against two- and three-engined transports seems to be disappearing. United and Continental Airlines have been watching Varig's operations with more than passing interest.

Although the Caravelle carries a braking parachute, which stops the aircraft in 500 metres, it has not been used. It is thought that passengers may not like the deceleration and that spectators would think that something was wrong.

On the flight deck of Varig's first Caravelle—which is seen in the heading picture on the apron at Pôrto Alegre, the carrier's home base.

As in other countries, terminal construction is lagging behind the introduction of jets. During runway lengthening, Rio's International Airport at Galeão has only 5,250 ft. of its single runway available for use. Frustrated international carriers are having to make extra refuelling stops. No plans for a new terminal are in sight. At São Paulo, a city of three million inhabitants, a new airport is being built 42 miles from the city. Pôrto Alegre's terminal, only finished in 1953, will be replaced by an entirely new airport with a 3,300-metre runway, to be completed in mid-1961.

The Caravelles will be supplemented in July, 1960, by the first of two Conway-engined Boeing 707 Intercontinentals. They will fly New York to Rio non-stop in 9¼ hours.

Varig stands for S.A. Emprêsa de Viação Aérea Rio Grandense (Rio Grande Air Transport Company). Started in 1927 by Brazilians of German descent, it did not begin international operations until 1955. Its 4,200 employees own about 85% of the shares, and run the company through a 500-man Colégio Deliberante. Each member has a vote for each year of service and they ratify the decisions of 16 directors. At the company's maintenance base at Pôrto Alegre, population 500,000, the company makes its own uniforms and radios, and sells some of the latter to the U.S. Government.

By law the aircrew of Brazilian carriers must be Brazilian nationals. Varig operates a Government-subsidized school in which pilots are trained, *ab initio*, in Cornells and Vultee Valiants. They graduate with 300 hours, but are not assured of a position. If no vacancy exists they may work temporarily as dispatchers or ticket agents, and later do 100 hours in a jump seat before becoming DC-3 co-pilots.

In addition to the Caravelles, Varig has five Super G Constellations, 13 Convair 240s, 21 32-passenger DC-3s and 15 C-46 Commandos. At one time the C-46s had two Palas jets under the wing, but the jets were sold to the air force when they proved uneconomical. The Commandos are being converted to Super 46 standard with L. B. Smith kits and will then have a good small-field performance.

A huge country (the fourth largest in the World) with poor communications, Brazil relies heavily on air travel. After the United States and Russia, she probably has the best developed air routes. Most domestic services from Rio de Janeiro originate from Santos Dumont Airport. This is a postage stamp which juts from the business district into the magnificent harbour. The single 4,350-ft. runway stops abruptly at the seawall; there is no underrun or overrun. Yet Constellations, DC-4s and all types of Convairliners stream from the field in endless procession; 115/145-grade fuel is used to coax an extra 100 h.p. per engine from the Convairliners. Nearby mountains (Sugar Loaf is at one end of the runway) provide assistance by venturi effect.

Even so, the field is so short that pilots tend to undershoot, thus eliminating the need to watch one variable (rate of descent). Propeller braking is de rigeur, and on one wet night our pilot braked with such enthusiasm that fumes poured in through the cabin vents.

Although one expects to be spoiled on international services (and I was not disappointed), more spartan rations are usual on domestic flights. On the Varig flight to Salvador, my reply to what I thought was "Do you want a taxi for two?" brought two martinis at 10 a.m. These were followed by a cold plate large enough to be a meal, superlative soup, filet mignon with four vegetables, dessert, excellent local wine, coffee and liqueur. Cloth serviettes and place mats, real china and crystal were standard. On several domestic flights each passenger was also given a small bottle of champagne.

A disinterested observer told me that this extra service had precipitated last year's price war. Under-the-counter fare discounts became common, and airline presidents made public accusations about each other. The Government clamped down and the fare for any trip now depends upon the Government class (four in number) into which your aircraft falls. For example, T-1 fares (Convairliner, Viscount, Constellation and tourist in Super Constellations) are 20% higher than T-2, which includes the DC-4 and Scandia. However, the discount is not entirely dead.

This PT-19 Cornell is one of several used for *ab initio* pilot training at Varig's Government-subsidized school. The pupils also fly Vultee Valiants.

Competition is keen everywhere; there are eight lines on the Rio-São Paulo route. The flights of three competitors often left at once, none more than 30% full. To cut costs, Varig, VASP and Cruzeiro do Sul formed the Ponte Aérea (Air Bridge) in July, 1959. Aircraft and counter services were pooled so that flights leave both Rio and São Paulo every 30 minutes. Reservations and meals were eliminated. Until a competitor complained to the Government, aircraft drew up in front of the terminal 30 minutes before flight time and passengers could wait in the aircraft. The one-hour pool service (10 hours by train, seven by coach) was such a success that the companies applied for a fare reduction, but were refused.

I made the flight in a Swedish Scandia, 16 of which are still used by VASP (pronounced Vaspee by Brazilians). The Scandia is slower and quieter than a Convairliner, with rather narrow, four-abreast seats.

According to Varig officials, 1959 was a crisis year for air transport in Brazil. Although passenger-miles continued to increase, the rate of increase dropped dramatically. Inflation, which boosted Rio's cost of living an astonishing 60% in 1959, is blamed. At the same time, the dollar shortage has made imports of navaids and aircraft difficult or impossible. Varig would like to buy 12 to 15 Handley Page Heralds or Fokker Friendships. Their increased productivity would make a reduction in fleet size possible, but the company cannot get exchange to make the purchase. Other Brazilian airlines face a similar problem.

Government fare-setting and other moves are aimed at increasing the industry's average load factor from 50% to 60%. Meanwhile, intense competition has discouraged Varig from starting a service to Europe. It now plans to consolidate its gains—52% of its overseas traffic is from foreign nationals—and prepare for increased tourist traffic. Brasilia, the new capital of Brazil, which opens on April 21, is expected to become the greatest tourist attraction in South America. Future progress depends upon the Government's ability to contain inflation, and on the foreign exchange situation—which, in turn, depends largely on coffee exports.

Three Brazilian airlines operate pooled services between Rio de Janeiro and São Paulo. One of the carriers, VASP, uses SAAB Scandias, one of which is seen here at Rio's Santos Dumont Airport, which is used for the majority of the domestic operations to and from the present capital.

The Fighting Services

New Honorary A.D.C.

AIR COMMANDANT A. STEPHENS, M.B.E., Director of the W.R.A.F., has become Honorary Aide-de-Camp to H.M. The Queen in succession to Air Cdt. Dame Henrietta Barnett, D.B.E., who gave up the appointment on retirement. Air Cdt. Stephens was previously the W.R.A.F. Administrative Officer at Headquarters, Technical Training Command.

Air Rank Appointments

AIR COMMODORE E. G. JONES, C.B., C.B.E., D.S.O., D.F.C., is to become Assistant Chief of Staff (Intelligence) at Headquarters, Allied Air Forces Central Europe, in June. He has been succeeded as Commandant of the Central Reconnaissance Establishment at Brampton by Air Cdre. L. Fox, D.S.O., D.F.C., who until recently was Assistant Chief of Staff (Operations and Training) at Headquarters, A.A.F.C.E.

Before becoming Commandant of C.R.E. in January, 1959, Air Cdre. Jones commanded R.A.F. Wyton and was attached to Headquarters Air Task Force in 1956 as Group Captain in charge of Operations during the Suez operation. Air Cdre. Fox was Deputy Air Officer in charge of Administration, Fighter Command, before going to A.A.F.C.E. in December, 1957.

A new technical appointment is that of Air Cdre. J. K. Rotherham, O.B.E., who has become Senior Technical Staff Officer at Headquarters, Transport Command. Assistant Chief of Staff (Maintenance) with the Pakistan Air Force for the past 2½ years, Air Cdre. Rotherham was previously S.T.S.O. at Air Task Force Headquarters.

Australian Aircraft Requirements

EARLIER this month the Australian Minister for Air, Mr. Osborne, told the House of Representatives that a mission would be going overseas in the very near future to investigate replacement aircraft for the R.A.A.F. He said that Air Vice-Marshal V. E. Hancock, Air Officer Commanding, R.A.A.F. Operations Command, two Service specialists and a Department of Supply official would visit the United Kingdom, France and the United States.

The replacement fighter, Mr. Osborne told the House, must be able to operate successfully from the available Australian airfields, must be versatile in giving solid support to ground forces and must maintain a high performance as an air defence weapon. He added that the choice of the future fighter had now been narrowed.

Mr. Osborne also said that finding a replacement for the Canberra was a most difficult problem. Australia needed a long-range light bomber capable of supersonic speed with precise navigation and other electronic equipment to enable it to operate accurately through cloud or at night. Such an aircraft did not exist now. The intercontinental strategic bomber was too specialized, too expensive and too demanding in airfield requirements to be within the reach of a small power.

Education Branch Dinner

AIR MARSHAL SIR ARTHUR W. B. McDONALD, Air Member for Personnel, replied to the toast of "the guests" at the 12th annual dinner of the R.A.F. Education Branch held at Overseas House, St. James's, London, last Friday. The other guests were Sir Maurice J. Dean, Permanent Under-Secretary of State for Air; E. T. Williams, Warden of Rhodes House, Oxford; I. Montgomery, Ministry of Defence; Instructor Rear Admiral Sir John Fleming, Director of the Naval Education Service; Maj.-Gen. S. Moore-Coulson, Director of Army Education; C. R. English, Ministry of Education; Air Cdre. G. N. E. Tindall-Carill-Worsley, Director of Technical Training; Air Cdre. D. F. Spotswood, Commandant of the R.A.F. College, Cranwell; and Air Vice-Marshal A. H. Robson, Director of Educational Services between 1944-52.

The toast of "the guests" was proposed by Air Vice-Marshal A. C. Kermode, Director of Educational Services, and Gp. Capt. P. H. Wood was in the chair.

Wheels-up Landings

A NEW system for covering a runway with foam to aid aircraft making a wheels-up landing has been perfected at R.A.F. Waddington.

The equipment, devised by the General Engineering Flight at the station, comprises a 30-ft. long 12,000-gallon tank mounted on a 50-ton crash recovery trailer. In 17 minutes it can coat a runway with a thick layer of foam for a distance of 1,000 yd.

Following experiments with foam-spreading attachments to fire-tenders, it was realized that the only way substantially to cut the laying time (anything up to 2 hr.) called for the use of a container big enough to put the carpet down in an unbroken flow. Within the tank now used a separate compartment has been constructed to hold the foam compound. Salvaged pipes and gate valves, a standard trailer-pump, and a 90-ft. wide spreader bar complete the unit.

Demonstrations attended by the A.O.C.-in-C. Bomber Command, Air Marshal Sir Kenneth Cross, and the local fire officers have shown just how efficiently a substantial foam carpet can be put down in this way. From an unprepared start it takes 15 min. to get into position on the runway. Then, towed by a Tugmaster at about 4 m.p.h., the trailer-mounted equipment disperses an even layer of foam 30 yards wide and 1,000 yards long in a further 17 minutes.

Depending on the towing speed, foam depth can be varied as required between two and five inches. A water to foam ratio of 27 to 1 gives a firm and lasting carpet.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. R. E. Havercroft, A.F.C., Wg. Cdr. D. J. H. Lay, D.S.O., D.F.C., and Sqn. Ldr. D. J. Vanstone to the Department of the Chief of the Air Staff, the latter with acting rank of Wg. Cdr.; Gp. Capt. J. C. Wickham, O.B.E., and Wg. Cdr. A. D. Rutherford-Jones to the Department of the Air Member for Supply and Organization at Harrogate.

Bomber Command: Gp. Capt. H. Burton, D.S.O., M.B.E., to R.A.F. Scampton to command; Wg. Cdr. J. G. Matthews, A.F.C., to No. 15 Squadron, R.A.F. Cottesmore, to command; Wg. Cdr. J. Miller, D.F.C., A.F.C., to No. 90 Squadron, R.A.F. Honington, to command; Sqn. Ldr. W. J. Roberts to Headquarters for radio duties, with acting rank of Wg. Cdr.

Fighter Command: Sqn. Ldr. G. D. Fuller to R.A.F. North Coates, as Officer in charge of Administration, with acting rank of Wg. Cdr.

Flying Training Command: Gp. Capt. R. P. R. Powell, D.F.C., Wg. Cdr. N. P. W. Conquer, O.B.E., and Wg. Cdr. C. A. Rennie, D.F.M., to the R.A.F. Staff College, Bracknell, for directing staff duties.

Technical Training Command: Wg. Cdr. A. J. S. Wilson, to R.A.F. Uxbridge, as Senior Dental Officer.

SERVICE TRIALS.—Two Westland Wessex anti-submarine helicopters were formally handed over to the Royal Navy at the beginning of this month for intensive Service trials by No. 700 "H" Flight (Lieut. Cdr. R. J. Turpin) at R.N.A.S. Culdrose. Here a Wessex is seen hovering over a line-up of pre-production and production types at Yeovil.

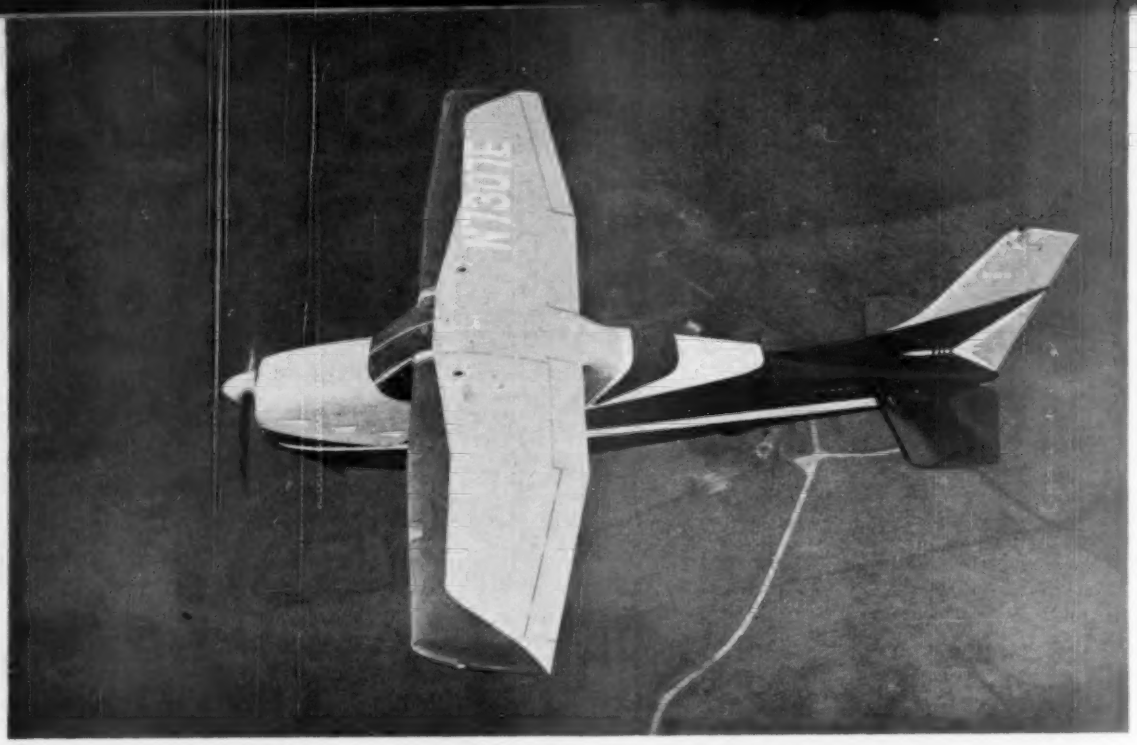
Guests of the R.A.F.

Last week pilots and groundcrew of No. 12 Wing, l'Armée de l'Air, from Cambrai visited this country as guests of the R.A.F. Flying Super Mystère B-2s, the detachment landed at R.A.F. Wattisham, the base of No. 111 Squadron.

Photographs copyright "The Aeroplane and Astronautics"

Left, the C.O. of No. 12 Wing, Commandant Bresset, being greeted on his arrival at Wattisham by Air Marshal Sir Hector McGregor, A.O.C.-in-C., Fighter Command.

Below, Commandant Bresset (extreme left) and his pilots outside the Headquarters of No. 111 Squadron. During their four-day stay they took part in exercises with Fighter Command.



Flying the Cessna 210

by John Fricker

NEWEST of the best-selling Cessna range of high-wing light aeroplanes, and the first to incorporate a retractable undercarriage, the Model 210 entered production late last year to compete with the high-speed low-wing monoplanes produced by other American manufacturers. The first Model 210 to reach this country (with only 91 hours on its tachometer recorder) was recently demonstrated by Airwork Services, Ltd., the U.K. Cessna agents, together with several other types of the same make. In all, these account for something like fifty per cent. of U.S. light aeroplane sales at the present time.

Cessna civil production is currently averaging about 400 aircraft per month, and although as yet the 210s make up a relatively small proportion of this total, their popularity is increasing daily. Their sales cover production for the next five months or so. The reasons for this became apparent on initial inspection of the visiting demonstrator, N7307E, at Blackbushe, as it stood on its low-set nosewheel gear in its eye-catching paint-scheme of bamboo, shadow blue and white.

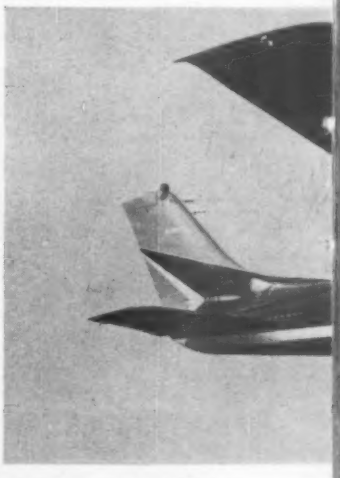
The importance attached to styling by Cessnas is reflected by the introduction of swept fins on seven of their nine light aircraft designs for 1960. This is one of the reasons for their sales lead in a fiercely competitive market. From such an advanced stage in aerodynamics and structures, Cessna can afford a diversion of effort, the all-metal single-strut braced high-wing airframes, with their Continental powerplants ranging from 100 to 260 b.h.p., offering combinations of qualities to satisfy the most extensive range of requirements.

As the highest-powered single-engined Cessna type, the 210 has the same 260 b.h.p. Continental I0-470-E flat-six fuel-injection powerplant as is fitted to the Model 310 executive twin. A plunger-type mixture control, with vernier adjustment, in addition to similar throttle and pitch levers in the cockpit, permits very precise regulation of fuel consumption, in conjunction with a fuel pressure gauge graduated from zero to 20 p.s.i., and showing altitude and percentage power settings for optimum engine operation. In so advanced an aeroplane, however, one might expect automatic mixture control.

The lower part of the engine cowling is extended to accommodate the forward-retracting nosewheel, on its air-oil strut, steered from the rudder pedals. When retracted, it is completely enclosed by doors, which also close after gear extension. The sectioned doors for the main-wheel legs, which are of the Cessna-originated and maintenance free chrome vanadium spring-steel type, operate in a similar manner, the main landing gear swinging ingeniously inwards and aft for fuselage stowage. Undercarriage retraction in a high-wing monoplane is always difficult, but a very neat and simple solution has been achieved in the Cessna 210, and combined with a wide track (8 ft. 2½ in.) for excellent ground stability.

Hydraulic actuation is employed, and fast retraction and extension times have been engineered. Flap operation is also hydraulic, the 210 retaining the very powerful NACA slotted "Para-Lift" flaps standard on all the Cessna high-wing range. A unique feature of the 210, however, is the introduction of down-curved wing-tips, which the company describe as conically cambered and say improve "spiral stability."

The attention to detail in 210 design is typified by such items as protective rubber covering over the tailplane leading edge for ground handling, and a self-opening external hatch, once it is unlocked, for the cabin baggage compartment, which has a capacity of 120 lb. The door is big enough to permit stretcher loading should the 210 be required for ambulance use.



The low-set roomy cabin is entered without difficulty via a step on the mainwheel legs, and a large door on each side of the fuselage. Both front seats slide for cabin access and leg length adjustment, and their backs may be tilted in three positions. The back of the rear seat is similarly adjustable.

The cabin of N7307E was a symphony of aquamarine and gold leather as I settled down in the left-hand seat alongside Joe Tyszko, chief pilot of Airwork Services, Ltd., for my first flight. It provided a haven of luxurious and tasteful comfort away from the cold and very misty elements at Blackbushe.

In such poor visibility, I was not over-impressed with the all-round view from the 210; it suffers the usual high-wing penalty in turns, and the windscreen framing is rather thick and unfortunately placed. There is a very large d.v. panel in the port window, however, which could offset the limitation of view in bad weather of the broad and deep nose of the 210.

The depth of the front bulkhead at least permits an impressive expanse of instrument panel, which has been put to good use. I had previously been gratified by the excellent instrument layout in the little Model 172, and the 210 conformed in having a full flight panel, plus ADF and (if required) VOR dials, on the port half of the dash, with the manifold pressure, r.p.m. and fuel pressure gauges over their respective control plungers, in the centre.

As in most American light aircraft, the fuel gauges, of auto-

mobile type, are less prominent than they could be, on the far right of the panel, while minor electrical controls are scattered rather confusingly below the starboard push-pull dual hand-wheel. Bottom centre is a separate console housing the functionally shaped hydraulic selectors for undercarriage and flaps.

Below the hydraulic console is the retractable lever for the emergency hand pump, and on the right, the cowl flap selector. Ample room is left on the panel for radio controls, and even a glove compartment. N7307E has a SunAir HF set, in addition to a Narco Mk. V VHF transceiver and Lear ADF, with a trailing aerial feeding out electrically alongside the ventral radio compass loop fairing.

With the umbrella-type parking brake lever under the left-hand side of the panel applied, after depressing the toe brakes on either set of rudder pedals, a touch of the starter button brings the Continental into life with a subdued and well-bred purr. The fuel selector lever, behind the elevator and rudder trim wheels on the central keel, has previously to be turned to either or both of the 27 Imp. gal. tanks in the wings, and the two-speed electric auxiliary fuel pumps switched to the "low" setting for priming.

As usual, with the closely cowled American types, engine warm-up is best done during taxi-ing. A twist of the throttle vernier gives sufficient power variation, and the single-disc wheel-brakes provide potent retardation.

They can also be used to supplement the nosewheel steering, which operates from the rudder pedals through 12 degrees each side of centre, before castoring through a total of 60 degrees. Joe Tyszko showed me how it is possible to turn the 210 within the width of the perimeter track, using steer and brake. The Americans have standardized on rudder-steered nosewheels for all their light aircraft, and there seems no excuse for any other system.

The cabin quietness is broken only by the crisp VHF reception from the loudspeaker, which is mounted in the roof forward of the interior and red panel lights and the four outlet points for the optional oxygen installation. The 210 rolls along on its cantilever steel gear like a well-sprung motorcar, introducing its pilot from the beginning to its keynote of effortless operation.

Even on the last quarter or so of Blackbushe's long into-wind runway no flap was necessary for take-off, and acceleration was satisfyingly rapid on opening up to 29 in. Hg. and 2,625 r.p.m. For maximum power at higher altitude airfields, the mixture lever must be regulated during take-off to match the fuel pressure needle against aerodrome elevation. Full-throttle torque necessitates a moderate amount of right rudder

Standard of comfort in the Cessna 210 cabin is high, and instrument layout is good. Dual control is an optional extra.

although the steerable nosewheel gives very positive directional control until unstick.

In a 20-knot wind, when later flying the 210, I found the elevator sufficiently responsive to raise and lower the nose slightly even when stationary and a steady aft movement of the control wheel at about 60 m.p.h. on a runway or continual back pressure on a grass surface will initiate a climb-away for initial obstacle clearance at 90 m.p.h. To keep the speed down to this figure necessitates an extraordinary angle of climb, although the undercarriage helps with a mild nose-up trim change as it thumps home five seconds after "up" selection.

Much more comfortable is the cruise climb, which can rapidly be established at 120-140 m.p.h. with a power reduction to 24 in. Hg. and 2,450 r.p.m. (75% power). The best rate of climb is achieved at 104 m.p.h., when full throttle will return about 1,300 ft./min. at the maximum weight of 2,900 lb.

On my first take-off at Blackbushe, it was necessary to go almost immediately on to instruments, as the 210 hurtled skywards, and climbed through a thin layer of cloud. This was sufficient, however, to demonstrate the excellent stability of the 210 for instrument flying, and the effectiveness of its control response was also immediately apparent. Among the kaleidoscopic jumble of initial impressions, however, were two of vague dislike: (a) for the dropping of the V.S.I. away from the main flight instrument group and (b) for the apparent sponginess of the rudder trim during the climb. Rudder bias is applied by a bungee spring in the circuit and, in N7307E, did not seem very positive.

Like all the Cessna range, the Model 210 is fairly sensitive to longitudinal trim changes with power and speed, and control in that plane appears to have been made deliberately on the heavy side to keep businessmen-pilots out of trouble. As the ailerons of the 210 are rather crisper than in the rest of this Cessna range, probably because of its higher speed, but are still light at all times, control harmonization is theoretically not as good as it might be. In practice, however, Cessnas have achieved a very good compromise from the point of view of practical handling, and the 210 is most pleasant to fly.

The only adverse effect resulting from the selected degree

How the wide-track main-wheel gear of the Cessna 210 is ingeniously retracted into the fuselage is shown in these photographs. The fairing doors are closed except when the undercarriage is moving. The conically cambered wing-tips are also apparent.

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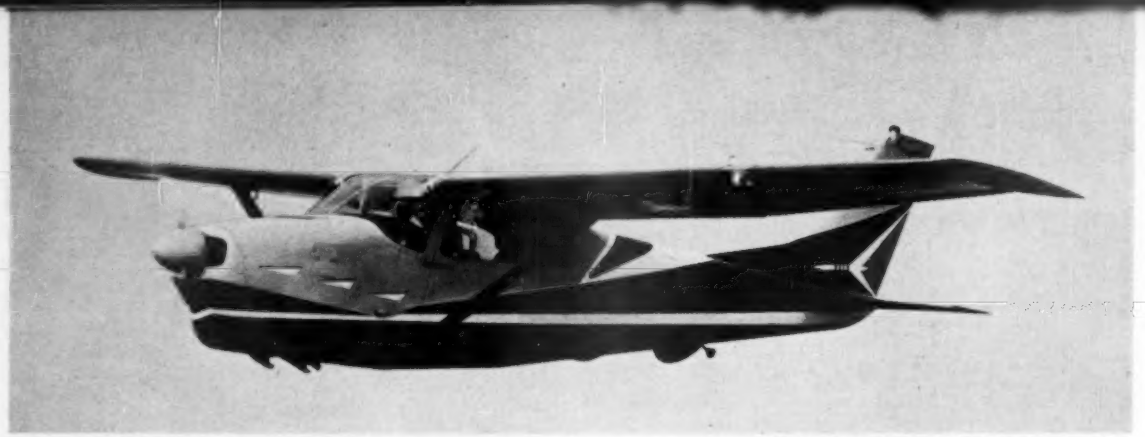

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of harmonization is that for the optimum comfort, fairly frequent recourse has to be made to the elevator trim wheel, and this is low geared, probably for similar reasons governing the elevator gradient. The rudder is effective in response but comes in for virtually no use after the take-off and climb, after which the 210 is not sensitive to trim directionally.

For a snap cruise check, I levelled out at 4,000 ft., and reduced power to 23 in. Hg. and 2,300 r.p.m. With four up and nearly full fuel, the 210 settled down to about 170 m.p.h. I.A.S., and showed remarkably solid stability in the very rough air. At the near-optimum height of 7,500 ft., it will return 179 m.p.h. T.A.S. at this power setting for a consumption of 10 Imp. gal./hr., while an easy 190 m.p.h. T.A.S is available at the 75% power setting of 24 in. and 2,450 r.p.m.

Like many of the highly streamlined American types, the 210 is then not far off its never-exceed speed, which is 200 m.p.h., but this characteristic seems to be universally accepted nowadays. A big point in the 210's favour is that the undercarriage, being of low drag design, has the high limit speed for extension of 160 m.p.h. and could, if necessary, be used as a form of air brake. The airframe load factors at the maximum weight are the normal +3.8 and −1.52 *g*, with 150% margins.

Speed for maximum range is 137 m.p.h. at 10,000 ft., and although only 45 of the 210's total of 54 Imp. gal. of fuel are usable, the remarkable low-power consumption of 5.8 Imp. gal. per hour will take you over 1,000 miles, at more than 23 a.m.p.g.

At the lower end of the speed scale, the Cessna 210 maintains its good handling qualities, lateral control, in particular, continuing to be light and effective. This is probably assisted by the end-plate effect of the down-curved wingtips, and is evident right down to the stall. A complete breakaway requires some persistence to achieve, and considerable aft pressure on the control wheel to raise the nose after power reduction.

Clean, the blipping of the stall-warning horn is imposed on the intermittent blast of the undercarriage klaxon, which follows closing the throttle, as the speed falls to about 65 m.p.h., and the 210 can be felt nibbling at the stall at around 60 m.p.h. I.A.S. Adequate control remains at this exaggerated attitude and a final aft heave is required to provoke a fairly abrupt breakaway, with a port wing drop at a T.A.S. of 65 m.p.h. (p.e.c. is then + 6 m.p.h.). Recovery is immediate with very little height loss, and it would seem difficult to make the 210 spin.

With everything down, stall breakaway is even more prolonged. Having such a satisfyingly high limit speed, the undercarriage can be lowered at almost any time to the accompaniment of a slight nose-down trim change, which is countered by initial extension of the powerful flaps. These can also be lowered at 160 m.p.h. for the first 10 degrees of their travel, although the remaining range, to 40 degrees, cannot be used above 110 m.p.h.

Trimmed in the approach configuration with a trickle of power at about 75 m.p.h., the 210 again needs a strong aft wheel pressure for stall exploration, and the warning horn begins sounding at about 50 m.p.h. I.A.S. I found that we went on flying quite happily as the speed passed through 40 m.p.h., and the final breakaway oscillation came at some quite indeterminate figure. Position error is then rather greater, however, but the stalling T.A.S. with everything down is still a very reasonable 59 m.p.h.

These manœuvres showed that it is possible to fly the 210 very comfortably in bad weather or other occasions at 75-80 m.p.h. with excellent control and at a substantial margin above the stall. The ailerons do not become soggy, and even in moderately severe turbulence at Blackbushe during my second flight, the approach at these speeds presented no difficulty. Stability remained excellent and control, precise.

On the first occasion, when a lighter wind was down the long runway, I came over the threshold, under Joe Tyszko's direction (and with some misgivings), at 800 ft., before lowering full flap and reducing power. For a moment, it clearly seemed that we should overshoot the runway, but as the powerful flaps took effect it became necessary to lower the nose to a remarkably steep angle to maintain about 80 m.p.h. on the A.S.I.

It soon became apparent that we could have continued at 800 ft. for quite some time, since the runway finally came up to meet us just after its half-way point. Elevator control remains pleasantly precise for the round-out, which with the potent flaps is best done fairly low, and the touch-down follows very gently at about 40 m.p.h. I.A.S. The 210 pitches softly forward on to its nosewheel of its own accord and can be brought to a standstill in an extraordinarily short space.

The slotted and area-increasing flaps of the Cessna range give these aircraft above-average take-off and landing performances, compared with many other American light aircraft of advanced design, which in general tend to be slightly underflapped. Nor do the "Para-Lift" flaps impose any particular demand on piloting techniques; trim-changes on overshooting from the approach configuration in the 210 are small, and it seems difficult to make a bad landing, however casually the aircraft is flung at the ground.

With such high standards of comfort, performance, handling and economy, the 210 must be reckoned as a formidable addition to the dazzling range of U.S. lightplanes. Its U.S. price, in standard form without radio, of $22,450 becomes £9.879 by the time the 210 is delivered and assembled in the U.K., and the exorbitant 17½% import duty paid. It still cannot be considered in any way excessive.

Leading Particulars

DIMENSIONS.—Span, 36 ft. 6 in.; length, 27 ft. 4 in.; height, 8.15 ft.; wing area, 175.5 sq. ft.

WEIGHTS.—Empty, 1,735 lb.; pilot and three passengers, 680 lb.; fuel (54 Imp. gal.), 383 lb.; oil (12 quarts), 13 lb.; baggage, 90 lb.; useful load, 1,165 lb.; maximum gross, 2,900 lb.

PERFORMANCE.—Max. speed, 199 m.p.h.; max. cruise (75% power at 7,000 ft.), 190 m.p.h.; initial climb, 1,300 ft./min.; service ceiling, 20,700 ft.; absolute ceiling, 22,400 ft.; take-off run, 740 ft.; to 50 ft., 1,135 ft.; landing run, 520 ft.; from 50 ft., 1,190 ft.; range max. cruise, 755 miles; endurance, 4 hr.; max. range at 10,000 ft., 1,100 miles; endurance, 8 hr.

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The Kenya Police Air Wing

TOWARDS the end of 1949, it was decided in Kenya that the Police Reserve should have an Air Wing, in order to assist the Security Forces. Although the Air Wing possessed no aircraft of its own when first formed, provision was made to mobilize any aircraft in the Colony that were required, together with pilots living in the Nairobi area. The first person to be enlisted was a volunteer, Mr. M. Bearcroft, who owned a farm near Molo. He offered his services to the Police, together with the Piper Cruiser which he owned.

To-day, the wing is staffed by eight full-time pilots, a ground staff officer, operations officer and a secretary. The Commandant, Wg. Cdr. A. N. Francombe, D.S.O., M.B.E., has just completed 30 years of flying in East Africa, apart from a six-year break during World War II.

The Air Wing is based at Wilson aerodrome which is a few miles outside Nairobi and is bounded on one side by Asian suburbs, and on another by a National Game Park. The aerodrome was formerly known as Nairobi West, but was renamed Wilson in honour of Mrs. F. K. Wilson, O.B.E., the famous pioneer of civil aviation in East Africa, who was the founder of Wilson Airways, the predecessors of East African Airways Corporation. The Police have as their neighbours the Aero Club of East Africa, and some local charter companies, one of which, Campling Bros. and Vanderwal, Ltd., do all Air Wing maintenance.

In 1950, part-time flying and ground staff were recruited, and a second-hand Auster was purchased. Enthusiasm was so great that, when a State of Emergency was declared in October, 1952, there was a well-trained and keen nucleus of staff in the Air Wing. As may be remembered, the Kikuyu, Embu and Meru tribes formed the secret society of Mau Mau, with the declared intention of killing all Europeans in the Colony, and destroying their property.

Photograph copyright "The Aeroplane and Astronautics"

Commandant of the Kenya Police Air Wing is Wg. Cdr. A. N. Francombe, D.S.O., M.B.E. (right), assisted by M. W. "Punch" Bearcroft, M.B.E., seen here at Wilson Field, Nairobi. In the heading photograph, three of the K.P.A.W. Cessna 180s are seen in formation alongside Mt. Kenya which is 17,058 ft. high.

To start with the Security Forces' main concern was the safeguarding of life and property, but when reinforcements arrived in Kenya it was possible to take offensive action against the gangs. As a result, many of the terrorists, estimated at one time to number 8,000, took refuge in the forests of the Aberdare Mountains and the forested areas of Mount Kenya, when life became too dangerous for them in the reserves.

Within hours of the declaration of a State of Emergency, the Air Wing had a fully operational base established at Nairobi West, working under the direction of the Police H.Q. in Nairobi, who co-ordinated with the Air Wing through the full-time staff officers at the airfield.

Almost immediately, there were many calls to the Air Wing for assistance, and aircraft had to be hired from the Aero Club, East African Airways and the charter companies. Some members of the Kenya Police Reserve used their own aircraft for police duties. The majority of the missions were reconnaissance flights over the tribal reserves and the forests of the Aberdares and Mt. Kenya. Communication flights were also operated for the Administration, Army and Police. A little later Air Wing aircraft began supporting Army teams working in the area.

At the beginning of 1953, the Army and Police stepped up their campaign against Mau Mau, and it appeared to be essential to have full-time pilots. At the same time, the Police decided to cease hiring aircraft and to buy more of their own. The poor performance of the Auster at high altitude made it unsuitable for the tasks and in the absence of a suitable British type of aircraft it was decided to purchase American Piper Pacers and Tri-Pacers.

Much stress must be laid on the high-altitude aspect of operations in Kenya, as most of the country is a plateau rising to about 5,000 ft., with mountains ranging from 6,500 to 16,500 ft. ASL, with Mt. Kenya the highest at 17,058 ft. Even quite important centres of habitation are at high altitude; for example, the town of Eldoret has an airfield at an elevation of 7,050 ft.

Some of the most important work of the Air Wing was to give guidance to ground patrols working in the forests, who were often hampered by not knowing their exact positions. In many parts of the forest it was at times just possible for a Land-Rover in four-wheel drive to average 2 m.p.h., and troops on foot could often only travel about half a mile a day due to the nature of the terrain. At first, difficulty was

About 150 strips are available for light aircraft use in Kenya, mostly between 5-7,000 ft. This one, at Eldoret, in the Northern region, is 7,050 ft. above sea level. It can be used by quite large aircraft, such as the R.A.F. Twin Pioneer from which this photograph was taken by John Fricker, during a recent visit to Kenya.

Photographs copyright "The Aeroplane and Astronautics"

experienced in pin-pointing positions due to the totally inadequate maps, until a 1 : 50,000 series was hurriedly prepared from air photos.

Before the R.A.F. Harvards assisted in 1953, some of the aircraft were utilized for the dropping of Type 36 grenades on terrorist gangs. When Harvards and Lincolns became operational, the Air Wing often had to mark targets with smoke or phosphorous bombs. This was necessary because of the difficulty experienced by R.A.F. pilots, unused to operating around such difficult country, to spot their own targets.

The gangs themselves were very elusive, as a result of which several targets were lost, as at least half an hour would elapse before R.A.F. aircraft could be positioned in response to a call from the Air Wing. To overcome this difficulty, a few aircraft were fitted with racks for carrying four 19-lb. anti-personnel bombs, thus enabling the Air Wing to make an immediate attack.

Another important activity was that of dropping supplies to patrols working in isolated positions. Many of the patrols were operating away from tracks, and a return to base for supplies would have been extremely time-wasting. Even after regaining a road, progress is likely to be slow and uncomfortable, as many of the roads, of graded murram, would be considered unsuitable for use even as cattle-tracks by most farmers in Britain.

For the air drops, Cessna 180s, which had by now been added to the fleet, were found to be the most suitable, and they carried out several successful drops above 16,000 ft. Due to the dense nature of the forests, a very high degree of accuracy was required, and supplies were free-dropped at tree-top level. Missing a D.Z. by as little as 50 yards would often mean that the package would be lost, or would fall into the hands of the terrorists.

Packing was undertaken for the Police by a specially trained Army unit.

The whole fleet, which had a maximum strength of 12 Pacers and Tri-Pacers, and 3 Cessnas, was equipped with WS88 army radios for liaison work.

There was also a Chipmunk, which was used for training and official mail flights between Nairobi and the main Army and Police operational bases.

Most of the pilots, of whom 16 were full-time, spent a considerable amount of time with a ground unit, usually a battalion, so as to acquire a full knowledge of the operations and movements, in order to reduce the risk of casualties among the ground troops when bombing.

At the peak period of the Emergency, the Air Wing at one time dropped more than 25 tons of food in less than 10 days, and flew more than 2,000 hours in one month, in varied weather conditions, on operations carried out between 8,000 and 15,000 ft. ASL.

On Jan. 1, 1957, the Air Wing ceased to be attached to the K.P.R., and was absorbed into the permanent Police Force with the title of Kenya Police Air Wing. Of the pilots who flew many thousands of operational hours during the Emergency, three remain with the Air Wing. Mr. M. Bearcroft, M.B.E., who is Deputy Commandant, a pilot of outstanding ability, lost a hand in an accident before he learned to fly. For his services during the Emergency he was awarded the Colonial Police Medal, and a Mention in Despatches, and C. A. Prichard and D. C. Hellens were both awarded Queen's Commendations.

Although the Air Wing is now staffed entirely by full-time personnel, a few pilots in the K.P.R. can be used if the need arises. At the end of 1957, the fleet was standardized and the eight Cessna 180s which were selected to form the new fleet are still in service.

The Cessna was found to be the most suitable of all the varied aircraft which were used during the Emergency, as it is able to operate from strips about 1,400 ft. long, even at high altitude, with a useful load. The aircraft has proved to be reliable, as indeed the whole fleet has been; from the start of the Emergency well over 40,000 hours have been flown by single-engined aircraft with no accidents attributed to mechanical defect.

The Cessnas each have two VHF radios; one, made by Pye, being used for the Police network, which enables an aircraft to be in direct communication with any police station or vehicle; the other, either a Narco or the Australian-made Airmite, being used for normal ATC work.

At present, the Air Wing performs some road traffic control work, but its main function is that of a communications flight. Because of the distances to be covered, and the state of the roads to be traversed, it is usually more economical for light aircraft to be used for the transportation of Government officials than to use a car.

The use of the Air Wing has enabled Government posts in the Northern Frontier District to have reliable and swift transport "on demand" if the need arises, and those places which used to be isolated during the rainy season now know that the Air Wing can be used to keep their lines of supply open. The Air Wing has calls at times to find hunters or tourists who are lost, or whose vehicles have broken down.

Suitable landing grounds can be found in many areas without improvisation. Details are known of 135 fields which the police can use, including strips maintained by farmers for their own aircraft. Many of the fields are definitely of a "bush" nature; a level, smooth strip with no obstructions on the approach being fairly uncommon—often the approach is over trees on to a strip which either has a decided gradient or resembles a switchback.

Another activity is the spotting of damage caused by big game, which can be troublesome, and passing reports to the Game Department. In order to make the best use of flying time, three pilots and aircraft are based permanently at Nyeri, about 70 miles from Nairobi. This town, situated between the Aberdares and the slopes of Mt. Kenya, is only a few miles from the Tree Tops salient in the Aberdares, where may be found the famous hotel where one may spend the night watching big game.

Although its main activities are in Kenya, the Air Wing is called upon by the other two East African Territories if they need assistance. The Uganda Police, who operate one Cessna, call upon the Kenya Police for relief when their only pilot is on leave.

R. Owen

Eight Cessna 180s are used by the K.P.A.W., and have proved, in the words of the Commandant, to be "fantastic aeroplanes." Their bare operating costs are about 6d. per mile, which is cheaper than road transport in Kenya.

U.S. Satellite Progress

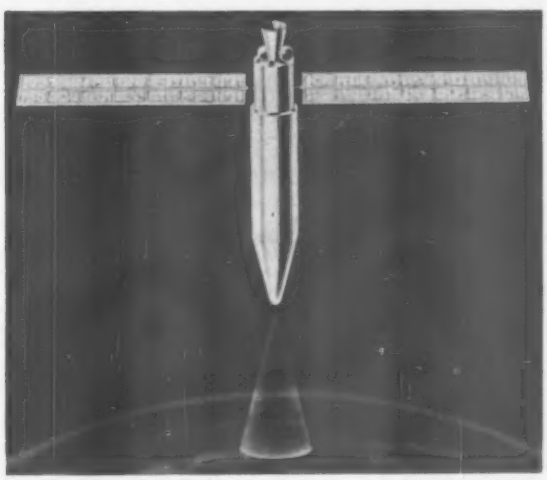
Details of the NASA Programme to Develop Meteorological and Communication Satellites.

OF the large number of satellites being developed in the United States, great interest is centred on those concerned with meteorology and communications. To some extent, these have grown out of experience gained with satellites designed for purely scientific purposes, for the investigation of the upper atmosphere, the ionosphere and the radiation belts. It might be well, therefore, for Britain, already at work on scientific satellites under a co-operative programme with the United States, to consider these future prospects in the light of contemporary work in America.

Meteorological and communication satellites were recently discussed before a House Committee on Science and Astronautics by Dr. Morris Tepper, Chief of NASA's Meteorological Satellite Program. He had some interesting things to say about the practical application of these developments.

America's meteorological satellite programme, he said, has been designed to obtain certain information needed by meteorologists in order that they might adequately describe and understand atmospheric processes and predict the weather more accurately and for longer periods ahead. This includes cloud observations, both day and night, on a global basis; the heat budget of the Earth and atmosphere; indirect measurements of the atmosphere; and radar coverage, giving world-wide precipitation information.

Instruments required to provide this information are: (a) photocells and television cameras (storm location, cloud cover, cloud type and cloud motion); (b) scanning infra-red radiation detectors (average temperature of the Earth's surface and lower atmosphere, temperature of cloud tops); (c) non-scanning infra-red radiation detectors (gross heat budget measurements, i.e. reflected solar radiation and radiation from Earth and atmosphere); (d) spectrometer (composition of atmosphere, water vapour, ozone, carbon dioxide and stratospheric temperatures); and (e) radar (rain and snow areas, heights and intensity of these layers).



First picture of the 650-lb. Nimbus satellite which is expected to follow Tiros in NASA's meteorological satellite programme. Pursuing a 600-mile polar orbit, Nimbus is to be orientated by pneumatic and inertial wheel techniques.

In 1959, two satellites were successfully launched containing major meteorological instrumentation. Vanguard II embodied a scanning photocell for mapping areas of high reflectivity (essentially cloud cover). Unfortunately, the satellite developed a wobble upon launching and some difficulty was experienced in reducing the data. Explorer VII, which is still providing useful information, contains as part of its scientific payload, a non-scanning IR radiation detector system for heat budget measurements.

Currently, America is concerned with Tiros I and II. Tiros I, successfully launched on Apr. 1, contains two television cameras for cloud cover photography; Tiros II will have in addition both scanning and non-scanning infra-red radiation detectors.

Accuracy requirements for the attitude control of the Nimbus satellite and other projected space-vehicles.

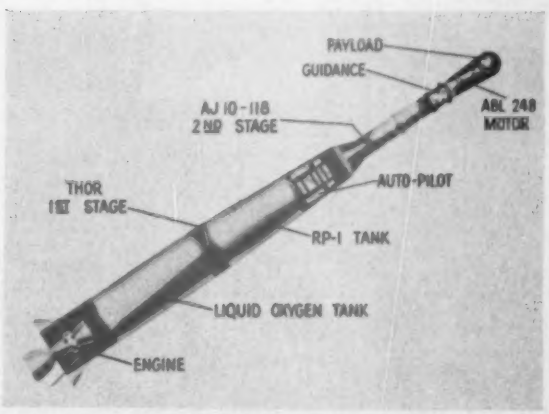
In a future programme—the series of satellites designated Nimbus—it is hoped to orbit improved instrumentation which has been developed from experience gained with previous satellites. Later versions of Nimbus, for example, are expected to carry a spectrometer and/or radar equipment.

Meteorological satellite data, particularly photographs of cloud cover, will present a new kind of data previously unavailable to the meteorologists. In order to develop techniques of analysis and photo-interpretation adequate to extract significant meteorological information, meteorologists are carefully studying all available photographs taken from high altitudes.

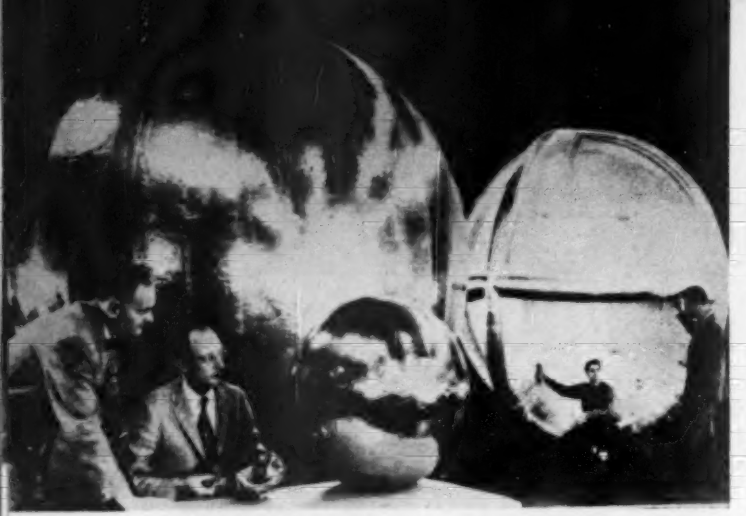
For example, during the past year, there have been several instances where a cine-camera was placed in a recoverable nose-cone of an Atlas or Thor ballistic missile. Although the primary purpose of the camera was to check the stability of the nose-cone, it turned out that some very good pictures of the Earth's cloud cover emerged as a by-product.

Similar studies, though necessarily more theoretical in nature, are being made in the fields of radiation, data handling, data processing, and operational utilization of satellite data, in order that the Weather Bureau should be better prepared to interpret and use the data when they are available.

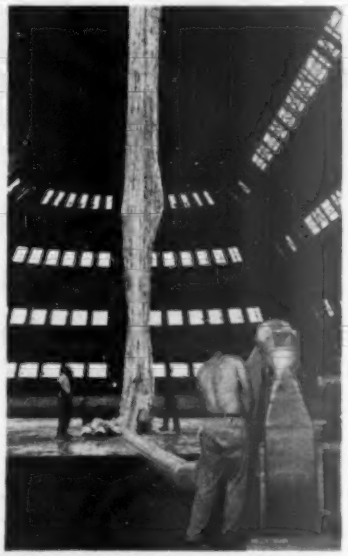
In order to understand the direction which NASA is following in its meteorological experiments, it is important, said



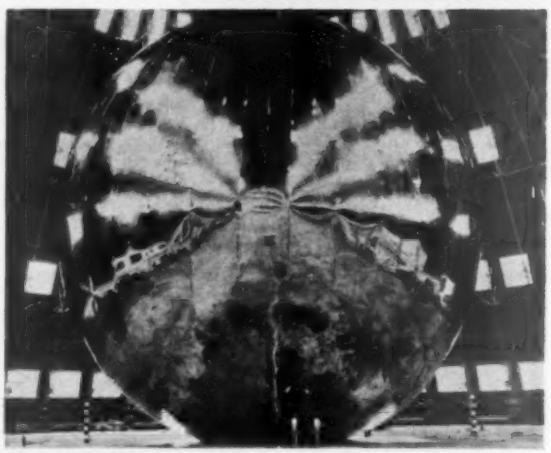
Sectional drawing of the three-stage Delta rocket which will shortly be used to orbit the first of three 100-ft. dia. inflatable satellites for experiments in radio communication.



Left, early test specimens of inflatable satellites developed by the National Advisory Committee for Aeronautics, now NASA. One (right) is a 12-ft. dia. "corner reflector" intended for use in radar experiments.



Right, inflation test of the 100-ft. dia. Project Echo satellite in a hanger at Langley Field, Virginia.



Dr. Tepper, to understand two of the basic limitations of Tiros. Tiros I was launched in an inclined orbit and is space-orientated. The former means that Tiros reaches a maximum northern and southern latitude about 50°. It will view events primarily between these latitudes so that poleward from these latitudes there can be little or no data from this satellite.

Secondly, by being space-orientated Tiros views the Earth only part of the time during its orbit. The rest of the time it looks glancingly at the Earth or out into space. The next satellite, Nimbus, will correct this. It will pursue a polar orbit and so will cover all latitudes from pole to pole; it will always face the Earth.

Maximum data acquisition from a satellite in a polar orbit would be from a station located at the pole or as close to it as feasible. Thus the possibility of establishing a station in the high latitudes at which Nimbus data might be acquired, is being investigated.

Satellite Communications

Satellites which can be used to provide communications over large areas of the Earth can be broadly classified as active repeater satellites and passive satellites. Active repeater satellites contain electronics and an appropriate power source which permit a radio signal, sent from one point on the Earth, to be received on-board the satellite, amplified, and then retransmitted to a distant receiver. Passive satellites merely reflect back toward the Earth radio signals originating on the Earth.

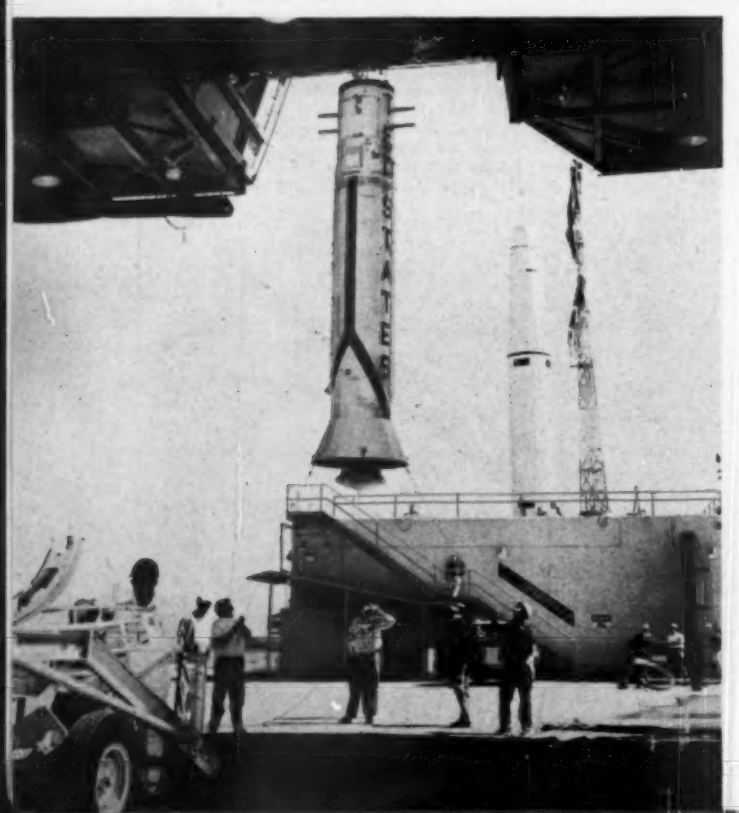
Certain forms of active repeater satellites are being developed by the Department of Defense. NASA is interested in establishing the technology necessary to the design of the more general communications satellites for civilian and commercial use. In the category of active repeater communications satellites, NASA is watching with interest and relying on the Defense Department's programmes to provide the early stages of development.

NASA has established a research and development programme related to passive communication satellites. Initial effort calls for the development of large spherical satellites and the investigation of this form of satellite as a communications medium. This programme has been named Project Echo.

A 100-ft. diameter inflatable spherical satellite, developed by the Langley Research Center, will be placed in a circular orbit about the Earth at an altitude of approximately 900 nautical miles. The satellite is made of Mylar plastic, 0.0005-in. thick, with a vapour-deposited coating of aluminium to provide reflectivity. It weighs approximately 136 lb. and has a surface area of 31,416 sq. ft. These Mylar spheres were fabricated under contract by General Mills Company and Schjeldahl Company.

The satellite is evacuated and folded into a 28-in. diameter container. It will be placed in orbit using a Delta vehicle, and the container will be opened to release the sphere. Approximately 20 lb. of a sublimating powder, placed inside the sphere, will cause the satellite to inflate in the vacuum of space.

To investigate the characteristics of this satellite as a communications medium and to determine the condition of the sphere in orbit, Project Echo calls for a series of communications experiments between JPL, Goldstone, California and BTL, Holmdel, New Jersey. Signals originating at Goldstone will



Preparing a Thor-Able rocket at Cape Canaveral. The new Delta variant has an improved radio-inertial guidance system.

be reflected by the satellite and received at Holmdel. Signals from Holmdel to Goldstone via the satellite will make use of a different frequency (960 mc/s as against 2390 mc/s).

The satellite has undergone considerable ground testing, but the real test is to inflate the payload in space. NASA does not possess a vacuum chamber large enough to inflate this type of structure on the ground. It has been possible, however, to inflate the 100-ft. dia. sphere in a large hangar at Weeksville, North Carolina, to determine the quality of construction.

In its deflated condition, folding presents a problem. The satellite is first folded on a special table into a long thin shape 153 ft. long with over 400 accordion-type pleats. After further careful folding, it is then packed into one-half of its spherical container, and the other half is fitted.

The Langley Research Center has scheduled several sub-orbital rocket firings of the 100-ft. sphere from Wallops Island. Two such tests have been performed: the first was on Oct. 28, 1959, and the second on Jan. 16 of this year.

In the first, the sphere ruptured on inflation. The second test suffered from a vehicle fault. However, the sphere was ejected and the data (which is still being analysed) indicates that the fault observed in the first test may have been successfully corrected.

Those participating in Project Echo are as follows:—

NASA's rôle is management, payload development, tracking, etc. The Jet Propulsion Laboratory is providing the West Coast communications site and Bell Telephone Laboratories, the East Coast communications site. Industry is providing many of the components; the Mylar spheres, radio beacons, antennas, transmitters, etc.

Last, but by no means least, are the independent experimenters. Although the military services will perform their own experiments, many other organizations will take advantage of this satellite and will make additional radio propagation experiments. NASA is co-operating with these experimenters and their effort, in turn, will augment the sum total of extremely valuable information from Project Echo.

NASA plans to launch three of these giant spheres (the first, in an inclined orbit and the last two, in polar orbits) to determine the usefulness of such spheres as communication satellites and to determine the technology required to place and sustain such large structures in space.

Needless to say, a single satellite of this type cannot comprise a satellite communication system. Even though communications can be established between any two stations within a rather large area, as the satellite moves relative to the Earth its area of coverage moves with it.

If continuous communication is to be maintained a number of satellites will have to be in orbit so that at least one is always in sight of the two stations desiring to communicate. It would need about 26 spheres in a 3,000-4,000 mile orbit to provide 99% availability, if the spheres were spaced at random. In view of this and the advent of larger boosters in the coming years, it is hoped eventually to place a number of spherical satellites in orbit with a *single* booster vehicle.

Feasibility studies of large structures and other, perhaps more efficient, reflectors will continue but the experience gained with Project Echo should provide an invaluable foundation on which to build the required technology.

The total sum required to carry out the satellite programme outlined is $26,300,000 of which $20,700,000 is for meteorological satellites and $5,600,000 for communications satellites.

At present, NASA does not have an active development programme in navigation satellites. However, a navigation satellite system is being developed by the Department of Defense and NASA is keeping in close touch with these developments so as to be in a position to evaluate the usefulness of this system, also, for civilian application.

How Big a Boost?

WHAT is the optimum size of a rocket engine? This question was discussed by Mr. J. E. P. Dunning, director of the Rocket Propulsion Establishment, in a Royal Aeronautical Society lecture on Apr. 7. His conclusion, based on R.P.E. studies at Westcott, was that the best size was around 50,000 lb. thrust, and that higher thrusts should be provided by clustered motors. Part of his discussion is given here; it is particularly interesting in view of U.S. work on a 1,500,000-lb.-thrust single-chamber motor. Mr. Dunning considers that by limiting engine size and clustering units the cost of a satellite programme could be kept within modest bounds.

Curves A and C of the accompanying figure, shown by Mr. Dunning, indicate that at the 25,000-lb.-thrust level the specific weight is above the optimum, but curve B gives an indication of possible developments and shows that the trend will be to shift the optimum down the thrust scale. "Conservatism in design," said Mr. Dunning, "played an ever-increasing part as our attention moved down the thrust scale with the result that the smaller engines possess more potential for development than do the larger ones. In this respect a factor of great importance is the operating pressure of the combustion chambers, which throughout the analysis on which this paper is based was taken as 535 lb./sq. in. absolute.

"As part of our studies Lewis investigated the effects of increasing the chamber pressure and concluded that at the 50,000-lb.-thrust level and below, a possible net improvement of 3% in specific impulse was available on this score alone. The possible net improvement at the higher thrust levels will not be so great because some weight penalty will be incurred to maintain stresses at an acceptable limit.

"Thus curves A, B, C (and D) will tend to shift their minima to lower weight figures at lower thrust levels. But it must be stated once more that the lower limit on size may be imposed by cooling considerations, which are not mitigated by increasing the operating pressures.

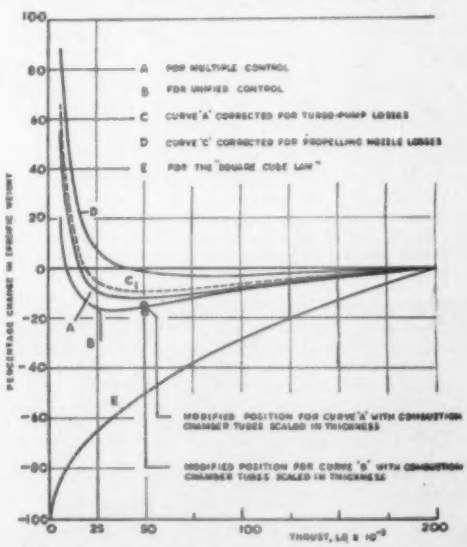
"Considering now the stated preference for an upper limit of size, assessed as 250,000 lb. thrust, this appears so far removed from the 'optimum' as to have no logical basis. Yet in what has already been stated, much logical justification has been implied.

"Apart from the actual cylindrical combustion chamber, the major components of the engine will adhere ever more closely to the 'Square-Cube Law' as the thrust spectrum is broadened above the 200,000-lb. level, and it may be stated with reasonable assurance that four 250,000-lb. thrust units will weigh less than one 1,000,000-lb. thrust unit and that the percentage difference in weight will be greater than that for the same ratio of thrust shown in the accompanying figure.

"But if 1,000,000 lb. of thrust is required, why restrict oneself to a quadruple unit? If the 50,000-lb. thrust unit is the optimum, why not use 20 of them? It is considered that the soundest answer to this question is given by our studies of the controls and mounting structures of multiple units, the problems of which are more critically dependent on numbers of units than on size of units, and 20 seems excessive. Four seem to be a 'natural' and up to nine are feasible.

"One hears frequently the argument that reliability is lost as the number of working components is increased. But if research has indicated the right course, reliability is more dependent on development than on any other factor and the amount of development which one can undertake is dependent on: (a) time available; (b) manpower available; and (c) size of unit to be developed.

"Time is always short and manpower is always at a premium, but, if we plan correctly, we have some choice in the size of unit to be developed and certainly for the case of rockets, the smaller the unit the greater is the development it can receive. Thus a cluster of rocket engines may well have much greater reliability than a single unit giving the same thrust."



Variation of rocket-engine specific weight with thrust relative to the specific weight of a 200,000-lb.-thrust engine.

Personal Flying

A MAJOR reshuffle has taken place in the organization of the flying training division of Derby Aviation, Ltd., the light aircraft activities now coming under the control of Air Schools, Ltd. This was the original company of the Group, formed 22 years ago to operate a flying school for the R.A.F., so the cycle is now complete.

In turn, Air Schools, Ltd., controls two entirely new companies; the first is the London School of Flying, Ltd., which takes over the operational activities of Elstree Flying Club, and the second is the Midland School of Flying, Ltd., which is responsible for Derby Air Centre. Elstree Flying Club will continue to function socially, but need not be joined by persons undertaking flying training with the air centre.

Board of the London School of Flying, Ltd., is Gp. Capt. C. A. B. Wilcock, O.B.E., A.F.C., A.F.R.Ae.S., M.P. (chairman); Ron Paine (managing director); M. M. Ager (secretary), and David Ogilvy. The last-mentioned remains chief instructor of Air Schools, with John Schooling as C.F.I. at Elstree, and Dennis Stuart occupying a similar post at Derby.

Activities at both Centres are expanding, and at Elstree there are eight full-time instructors, plus four part-timers. At Derby there are two of each, and the combined aircraft fleet comprises seven Chipmunks and four Austers. The instructor/aircraft ratio is unusually high because nearly all the flying is training work, and in the spring and summer continues virtually from dawn until dusk (and sometimes later for night flying).

The pre-War Air Schools Wings have been redesigned for suitably qualified pilots, while an innovation is the Air Schools instrument rating for the private pilot, which is an essential qualification for the wings. Other requirements include night flying, aerobatics, advanced navigation and a technical examination.

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● A recent meeting at Cheadle Hulme, Cheshire, resulted in the formation of the new Manchester Flying Club, to replace the disbanded Ringway Aero Club. Permission is being sought for the club to fly its secretary's Luton Major and Auster aircraft at Manchester Airport. Social venue of the Club is the Ravenoak Hotel at Cheadle Hulme, where the C.F.I., Harry Knight, hon. sec. Jack Cowap, treasurer David Needham and chairman Ken Clayton may be found most Thursday evenings. Details may also be obtained from the hon. sec. at 1 Manor Road, Abbey Hills, Oldham.

AUSTRIAN JOB.—The wooden 2-3-seat Oberlerchner JOB-5 sports and touring light aircraft is flying in Austria, powered by a 90 b.h.p. Continental C-90-12F. Gross weight is 1,507 lb. Production variants will have the 135 b.h.p. Lycoming O-290 engine.

● A third Tiger Moth is to be purchased by the Norfolk and Norwich Aero Club, and after being painted in the club colours and having a glider-towing hook fitted, is being delivered to Swanton Morley. A trophy has been presented by Sir Robert Bignold for annual competition among members for the best airmanship. P.P.L.s have been obtained by Bill Reekie, Peter French and Gilbert Burton, while first solos have been achieved by Roger Mason and Frank Alden.

● February was another record-breaking flying month for the Oxford Aeroplane Club, although achieved without the Chipmunk, which was on C. of A. overhaul. John Knipe made his first solo flight; Lex Browne and David Bennett converted to the Auster, and Michael Eustatiou is learning to fly his newly acquired Tri-Pacer with the Club.

● February solo pilots at the Surrey and Kent Flying Club, Biggin Hill, were Messrs. J. English, D. Jackson and Malford-Davis. From the first week in April, the Club's fleet is being increased by the addition of two six-seater ATL Prentices. These are lighter in weight than the club's original aircraft and equipped with long-range fuel tanks and spare VHF sets, and will be excellent for touring. They can be flown at £6 10s. an hour, decreasing to £5 15s. at contract rate.

Gliding Notes

by Dr. A. E. Slater

NEWS of the Australian entry in this year's World Championships comes from Allan Ash, secretary of the Gliding Federation of Australia. The pilot will be Robert S. Rowe, now in his late thirties, who has been flying gliders since about 1938, has logged just on 1,000 hours in more than 40 different types of sailplane, and has a Gold "C," with goal Diamond. He won the South Australian Gliding Championship in 1958. He has a 14-year-old son, who holds a Silver "C."

His team manager will be Phyllis Cameron, who works as a nurse in an American hospital in Germany. Graham Croker of the Victorian Motorless Flight Group will complete the crew.

Bob Rowe will probably fly a hired German Ka-6, although he is trying to negotiate for the free loan of a Czechoslovakian Blanik.

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A FREE ride with Soaring Holidays (Glider Hire), Ltd. took me to the Derbyshire and Lancashire Club, whose turn it was to be shown this novel equipment consisting of a caravan trailer fully equipped for four people to live in, and an Olympia 2 which can occupy the trailer while it is travelling around to gliding centres on returning from a retrieve. After the club members had been shown round in relays, and had all their awkward questions satisfactorily answered by Mr. T. Quinn Hall, as usual, the Olympia's waterproof plastic covers stood up well to the wet and dirty night of Apr. 2-3, and the machine, after spending 24 hours fully rigged in the open, was bone-dry when it was put away in the rain next afternoon. The covers could be left on the various sections during de-rigging and inside the trailer.

Among suggestions put to Mr. Hall was one that he should keep a sailplane-plus-caravan unit in France for the use of the increasing number of British pilots who visit French gliding centres. But he had thought of that one too; when the scheme is well under way he will keep two units in France.

Derbyshire and Lancashire Gliding Club now has a fleet of eight aircraft: T-21, T-31, Skylark 2, Olympia, two Prefects and two Tutors. Privately owned machines are an Eagle, Sky, Skylark 3, Gull 4 and sundry Olympias —no one was sure of the precise number, but it is around three or four.

Cyril Kaye, one of the club's founders, has designed a specially powerful winch for launching the Eagle owned by his son Michael, which is rather heavy for an ordinary winch to cope with. This new winch has an American Buda engine of 110 b.h.p., with a fluid flywheel which makes it self-regulatory: if you pull up too much on the launch, the winch slows down, but if you hold your nose down, it begins to race. It is liable to race all the time with a light glider.

Another apparatus, installed since I was last there, is a German Pfeifer cable-retrieving winch, which had cost £250. It subtracts about 50 feet from the height of a launch, but enables a lot more launches to be made per hour. Recently, 25 launches were done in 2½ hours.

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BERNARD THOMAS, formerly club secretary, has been helping the newly formed Doncaster Gliding Club as an instructor. He looks forward to increasing co-operation between the two clubs in the future, with aero-towing from Doncaster airfield and hill-soaring at Camphill available to both clubs.

Fred Coleman was around, still using a stick, but before long he expects to start rebuilding his two-seater Harbinger.

Also going around was a young boy, evidently on an "initiative" test, whose task was to get the name of the club president. Actually the president died recently; he was Mr. H. C. B. Bowles, of Baslow, who owned the land and first leased Camphill Farm and the flying field to the club in 1935. He has always been very friendly, and the only stipulation he made was that flying should cease for two weeks each August in the interests of game preservation.

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CALLING in at Dunstable on Mar. 26 was Philip Wills, to collect his Skylark 3 which had been brought there by Fred Slingsby after its tail had been brought up-to-date to conform to the latest model. Wills is taking it to Texas, where the United States Championships are being held in early August at Ector County Airport, Odessa. L. Gale Abels, of Boulder, Colorado, is to crew for him. It is expected that the Skylark will be sold later in America.

Mohawk by Grumman

IN production for the U.S. Army, the Grumman Mohawk is a high-performance STOL observation and ground-support aircraft designed to operate from small, unprepared landing strips. It is powered by two 1,005-e.h.p. Lycoming T-53 turboprops and can take-off over a 50-ft. obstacle in less than 220 yd. Despite its STOL performance, it has a top speed of 316 m.p.h. and a range, with two underwing tanks, of 1,670 miles. Details of its dimensions, weights and performance are given on the next page.

The initial order by the U.S. Army covered nine Mohawk YAO-1s for service tests and evolution. This was followed last year by an order for 35 AO-1AF production aircraft and recently 42 more Mohawks were ordered; these will probably be an improved "B" model.

A successor to the current side-looking airborne radar (SLAR) is being developed as part of the Mohawk combat surveillance system. The aircraft can also be used for close support, in which rôle it carries armament such as anti-tank missiles and napalm bombs on underwing pylons.

Two crew members, a pilot and an observer, are carried in the Mohawk side by side; both have Martin-Baker ejector seats. Bubble-type side panels ensure a good downward view from the aircraft; they fold upwards and give access to the cockpit. Crew members can eject through the roof hatch if necessary. The cockpit is well forward of the wing and propellers, ensuring a good view for both occupants.

The wing of the Mohawk has full-span, leading-edge slats and large trailing-edge flaps which can be lowered 15° or 45°. The T-53 engines are mounted above the wing; the left and right powerplants are interchangeable. An engine can be removed or installed by two men in 30 minutes, using a Grumman-designed davit which is attached to the wing, and a standard bomb hoist.

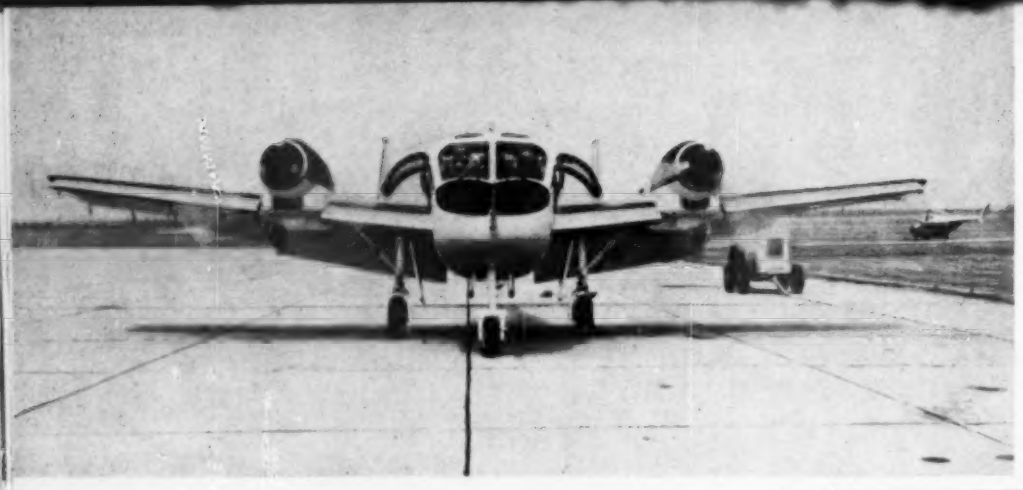
A single internal fuel tank is mounted in the fuselage. There is a camera compartment under the fuselage and a compartment for radio and electronic equipment behind the fuel tank. Behind this there are airbrakes on each side of the fuselage. They are pivoted just behind the equipment bay and move through 60°.

The Mohawk was originally designed with a single tall fin and rudder. This was abandoned to avoid the need for a hybrid rudder control system which was partly manual and partly powered, with a variable-incidence tailplane. The undercarriage, with low-pressure tyres, is designed for a maximum vertical velocity of 17 ft./sec. The main legs retract sideways

INSIDE THE MOHAWK.—The instrument panel slopes forward at 15° from the vertical. Power, propeller, landing-gear, flap gust-lock and trim-tab controls are mounted on a central pedestal.

SAFETY SEATED.—Unusual in an aircraft of the Mohawk's type are the Martin-Baker ejector seats for its two crew members.

Howard Levy photographs



STOL OBSERVER.—Full-span leading-edge slats and large trailing-edge flaps help give the high-powered Mohawk its excellent STOL performance.

AIRBRAKE.—The Mohawk's airbrakes are on the fuselage side just behind the radio and electronics compartment.

into the underside of the nacelles; the nosewheel retracts backwards into the fuselage.

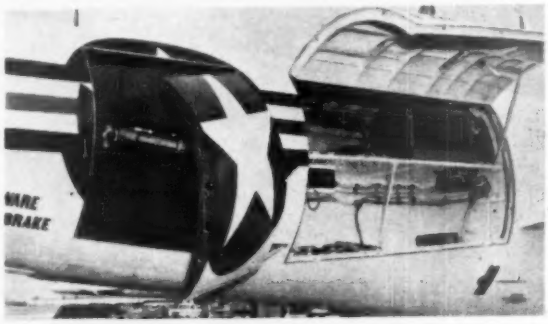
In designing the aircraft emphasis was placed on easy maintenance in the field. All equipment bays can be reached by personnel standing on the ground.

Technical Data

DIMENSIONS.—Span, 42 ft.; length, 41 ft.; height, 12 ft. 8 in.; wing area, 330 sq. ft.; flap area, 43.6 sq. ft.

WEIGHTS.—Empty, 7,772 lb.; useful load, 2,316 lb.; gross, 10,088 lb.

PERFORMANCE.—Take-off distance to 50 ft., 655 ft.; initial rate of climb, 3,000 ft./min.; service ceiling, 32,500 ft.; max. speed, 316 m.p.h.; endurance, 2 hours cruising at 230 m.p.h. at 5,000 ft.; endurance with two 150-gal. underwing tanks, nearly 7 hr. cruising at 239 m.p.h. at 25,000 ft., giving a range of 1,670 miles; landing speed, 64 m.p.h.; landing distance over a 50-ft. obstacle, 776 ft.



The Air League calls for a M=3 VTOLiner

IN August, 1957, the Air Transport Committee (under the chairmanship of Sir Miles Thomas) of the Air League of the British Empire issued a vigorous report on the requirements for the British aircraft and airline industries. Last week the Committee issued a second report, pressing for decisions which have still to be made to assure the future of the two industries concerned. Their recommendations:—

"1. In the long-term, long-range field, we believe that a supersonic airliner with a speed of Mach 3 that takes off and lands vertically instead of on a wheeled undercarriage should be developed as rapidly as possible, for both civil and military use.

"2. At the same time vertical take-off should also be incorporated in a subsonic short- to medium-stage high passenger-density aircraft, for operation at low fares. This we call the Air-Bus. It, too, could have a troop-carrying rôle.

"3. In so far as the interim stages of aircraft development are concerned, we believe that the policy of low fares leading to accelerated economic prosperity of airlines can be achieved by the development of high-density subsonic jet aircraft, such as the Vanguard and a "stretched" and developed version of the D.H.121.

"4. As a stepping stone to the development of jet-lift VTOL airliners, it is our opinion that aircraft such as the Fairey Rotodyne and helicopters should be vigorously encouraged and the use of airports that are nearer to population centres than the current runway-equipped airfields should be exploited. This will also give an opportunity for the development of an organization and an air control system that ensures the greatest benefit from vertical take-off and landing.

"5. We believe that automatic air traffic control, both for the current sloping approach and take-off paths and also for VTOL traffic, must be developed as a matter of urgency and safety. Automatic landing control of aircraft must also be progressed to the point of complete dependability, regardless of human visibility."

Points from the report which merit special quotation:—

Dealing with the future of British aviation exports:—

"There is deep concern amongst members of the Air League that the general public may be seriously misled by the oft-quoted figures for British aviation exports. The facts are that a very large proportion of these sums are attributable to the export of engines, airframes and equipment whose development was the result of Service needs, and they represent the last fling of the pre-1957 Defence White Paper era. It is now necessary to face up to the problem of maintaining the export rate of trade without the stimulus of military orders which made it possible."

Of the British supersonic transport prospects:—

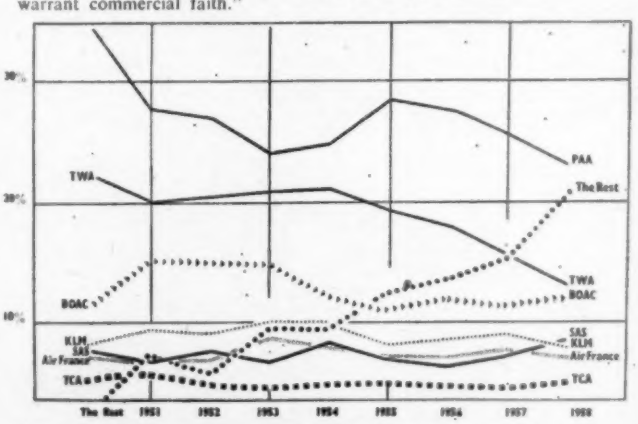
"It is suggested that both at Government and commercial levels the high state of development of British jet aero engines should be vigorously promoted in conjunction with foreign supersonic airframe designers so that the existing pattern of British aero engines being exported for use in the airframes of other national manufactures can be continued into the supersonic era.

"It is now possible to envisage small British-built gas-turbine engines capable of lifting 16 times their own weight; a battery of such engines when installed in a suitable aircraft could be reasonably expected to amount to only some 13% of the all-up weight of the structure in which they are employed.

"This opens up a new and economic route to supersonic air travel for both civil and military purposes. Direct lift would then become a substitute for all the paraphernalia associated with runway landings. . .

Of automatic air traffic control:—

"And again, when considering these systems, the change from the valve to the transistor in electronics must be clearly borne in mind. Dependability is paramount; but when the delicate filament of a valve is replaced by a sturdy wafer of a metal that is not subject to the violent temperature variations, the reliance that can be placed on transistors, particularly when they are duplicated and triplicated in 'fail-safe' ganging, is sufficient to warrant commercial faith."



Shares in the North Atlantic Passenger Trade as percentages of annual total.

Correspondence

American Personal Aircraft

BASED on our current experience the Personal Flying notes (Mar. 25 issue) present an unduly pessimistic view of the cost and complications of obtaining a British public transport category C. of A. for American personal aircraft. Normally the only difficulty is that a flight manual is legally required for commercial operation in this country, but is not required in America for aircraft less than 6,000 lb. A.U.W.; in some cases the manufacturers do not consider that the United Kingdom market justifies preparation of the manual, which would be formidable to a company not familiar with the British civil airworthiness requirements.

In order to assist importers who are experiencing this problem, our company has a small specialist group who flight test the aircraft, prepare the flight manual and obtain A.R.B. approval for it. To date manuals have been produced for four types and the average cost has been less than 3% of the price of one aircraft. As it is only necessary to produce one manual for each type of aircraft, this cost would normally be defrayed over several aircraft; even if the cost is entirely borne by one aircraft it is negligible by comparison with the earning capacity which its public transport category permits.

Shoreham, Sussex. H. E. FORSDIKE.
(Group Commercial Manager, F. G. Miles, Ltd.)

Was it the "Southern Cross"?

IT must be nearly 25 years ago, but I believe the incident recalled by Gp. Capt. Lang (Feb. 26) occurred in the Avro X (registration VH-UXX) named "Faith in Australia."

Am I right?

Lloyd's, E.C.3. L. W. COLLINS.

The Fabulous Mr. Hughes

HAVING read (as I always do) Chris Wren's "Wroundabout" column, I must confess I was greatly amused in what he had to say about multi-millionaire Howard Hughes in your issue of Feb. 12, p. 206.

I understand Mr. Hughes' latest purchase is an Executive-type Convair 880, costing around two million dollars: undoubtedly his most expensive aeroplane so far.

I am fairly sure nobody else in the World has, in their lifetime to date, owned so many types of American aeroplanes, and especially including "famous airliner-types!"

Starting off, back in 1934, was his specially built "Twin-Wasp Junior Racer" (in which he set a World's Record of 352 m.p.h. in 1935). In 1936 he purchased the one and only DC-1 built. Greatly modified, he intended to use it on his planned round-the-World flight. Exhaustive tests were made, but Hughes eventually decided a specially modified Lockheed 14 Super-Electra was a better aeroplane for the job. Named "New York World's Fair," in it, as most of us will recall, Hughes and his four-man crew flew it nearly 15,000 miles in under four days, the fastest round-the-World flight in July, 1938.

Hughes' next aircraft was a Boeing 307 Stratoliner (NC.19910) which he acquired (from the makers) in 1940. He doesn't seem to have used this aircraft very much, and he sold it to Aerovias Ecuatorianas after World War II. It finally ended its career on Oct. 5, 1958, when it crashed in the U.S.A., being owned then by Quaker City Airlines, Inc.

His next was an L.49 Connie (it was actually the original prototype). Hughes bought it for a mere 40,000 dollars from the U.S. War Assets Admin. Board in November, 1945. In his ownership it flew less than 100 hrs. and early in 1950 Hughes sold it back to Lockheeds. They "rebuilt" it completely, and on Oct. 13, 1950, it flew as the L.1049 Super-Connie prototype.

For some obscure reasons Hughes owned two ex-K.L.M. L.49s (PH-TAW and PH-T??) after they were traded back to Lockheeds in 1949-50. His "ownership" of both these transports was probably some kind of complicated financial arrangement between his "Hughes Empire" and T.W.A. Both these L.49s are still flying on T.W.A.'s domestic routes!

Currently, Hughes owns a DC-6B (N.7780B) and a VIP-type Convair 240 (N.24927).

Finally, according to H.H.'s more-than-colourful biography (by Lewis Dewey), back in 1927 H.H., accompanied by "several aviation specialists" (and including ex-World War I pilots), visited England (also France and Germany) purchasing all remaining S.E.5s, Sopwith Camels, Snipes and Avro 504s, etc., which he and his party were able to acquire through various sources! The machines were crated and shipped to Hollywood for use in his "Hell's Angels" which took three years to make, costing almost £1 million to produce. It would certainly be interesting to learn if any old-timers in the U.K. industry can confirm the authenticity of this part of the H.H. biography.

Nairobi, Kenya. DENNIS M. POWELL.

Wroundabout

Man of Principle. If you think all Americans are totally materialistic, make a note of the name of Tom Lanphier. He has just resigned his $50,000 p.a. job with Convair in protest against the U.S. administration's "underestimation of the Soviet military threat" and their "overestimation of the strength and survivability of American defences." A distinguished W.W.II fighter pilot, he rose to become in 1951 a Convair vice-president and contributed much to their F-102, F-106, B-58 and Atlas programmes. Frank Pace, chairman of General Dynamics (of which Convair is a Division), announcing Tom's decision at a GD board dinner, said "We hate to lose him—he has big ideas, big ideals," at which point Tom broke in to comment "... and a big mouth!"

*

"Let's face it—rockets are getting too big for their boost."

*

"Well, I'll say this for him—he approaches every problem with an open mouth."

*

Uncle Wren's Information Bureau

"*Hopeful*," *London, S.E.12:* No, the words indicated by "V.T.O." are *not* intended to describe a strip-tease act.

"*Apprehensive*," *R.A.F. Marham:* You have been worrying unnecessarily. "L.A.B.S." stands for "Low Altitude Bombing System," not "Loop and Be off Smartly."

*

Megaweight. A toolmaker friend in Canada is intrigued by the scientists' "megaton" and "kiloton" method of weight expression and by such examples as the "0.01 kiloton" explosions of the Martin Company's projected space propulsion system. He wonders if it will spread through the whole weight range.

by Wren

Industry Record

Precision Flow Measurement

A turbine-type of flowmeter incorporating an hydraulically positioned bearingless rotor is now being produced and developed by de Havilland Propellers, Ltd. Marketed as the de Havilland Pottermeter, it is manufactured by the company in this country under licence from the Potter Aeronautical Corporation of Union, New Jersey, U.S.A.

The complete system comprises a sensing element, which can be installed in existing piping, and an indicating or recording unit. This latter component can be placed at any distance from the sensing element and used for metering a wide range of solvents, liquefied gas and solutions including liquid oxygen, oil and general aviation fuels.

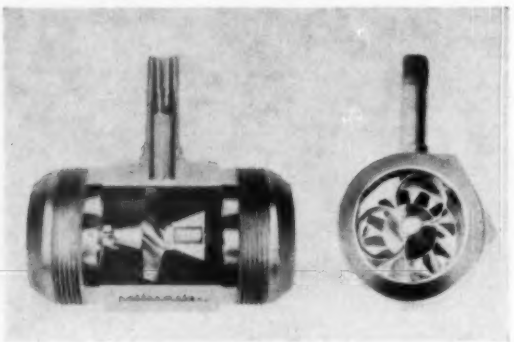
Based on a feature known as the "pull-up" principle, the flow sensing element consists of the turbine-type rotor suspended in an axial "floating" position by the kinetic energy of the measured fluid, so that the rotor spins at a rate directly proportional to the velocity of the flow through the unit.

In the standard element, a small permanent magnet is mounted within the body of the rotor and polarized at right angles to the axis of rotation. As the rotor spins, this magnet sets up an alternating current in a coil within its field. The total number of pulses generated by the sensing unit is directly proportional to the total quantity of liquid passing through it. The frequency of the alternating current produced is directly proportional to the rate of flow through the unit.

Therefore, operated in conjunction with an electronic totalizer, the sensing unit can be used to measure flow. Coupled to a frequency converter, which produces a DC signal proportional to flow, the system provides a measurement of the rate of flow by either a milliammeter, a potentiometer or a high-speed recorder.

Non-magnetic stainless steel has wide application and a standard sensing element manufactured in this material can withstand pressures of up to 5,000 p.s.i. For higher pressures, a special unit with the pick-up coil mounted outside of the pressure line in a position opposite the rotor is employed.

The Pottermeter is available in a standard range of sizes suitable for measurement of flows from 0.1 Imp.g.p.m. to 4,500 Imp.g.p.m., although larger sizes can be produced. The sensing unit is capable of operating over a temperature range from −455°F. to +1,500°F.



A sectional view of a standard de Havilland Pottermeter designed for precision flow measurements.

Heat-resisting Alloys

A new publication "Nimocast Heat-Resisting Alloys" has been published by Henry Wiggin and Co., Ltd. The Nimocast series of cast alloys which combine high-temperature strength and scaling resistance, are similar to, and in some instances identical in composition with the company's Nimonic series of wrought alloys.

The major part of the publication is devoted to the physical and mechanical properties of these cast alloys and is recorded in tabular form. The tables include the physical properties, standard heat-treatment, oxidation data, and recommended pouring temperatures. Also included are a series of stress rupture graphs covering all the Nimocast alloys; in some instances tests have been carried out for over 3,000 hours. A chapter entitled "Further Developments" deals with the company's progressive research programme and refers to work on three new casting materials offering improved properties.

Copies can be obtained free on request from the company's Publicity Department at Thames House, Millbank, London, S.W.1.

Aviation Calendar

Apr. 20

Reading.—R.Ae.S. Reading Branch lecture, "The Radio Telescope," by Dr. H. P. Palmer, in the Top Canteen, Western Manufacturing, Ltd., at 18.00 hrs.

Apr. 21

Birmingham.—Institution of Mechanical Engineers lecture, "The Future of Air-Breathing Engines in Aviation," by S. G. Hooker, at the Mathew Boulton Technical College, Suffolk Street, at 18.00 hrs.

London.—R.Ae.S. Astronautics and Guided Flight Section lecture, "On Reducing Costs of Space Research," by J. E. Allen, at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1, at 18.00 hrs.

Yeovil.—R.Ae.S. Yeovil Branch Junior Paper evening at Park School, Park Road, at 19.30 hrs.

Apr. 22

Birmingham.—R.Ae.S. Birmingham and Wolverhampton Branch film night, at the Engineering Centre, at 19.30 hrs.

London.—R.Ae.S. Agricultural Aviation Group lecture, "Pilot Training," by Capt. Richard Bradbury, in the Library, 4 Hamilton Place, W.1, at 19.00 hrs.

Apr. 25

London.—NATO AGARD Wind Tunnel and Model Testing Panel meeting on "Boundary Layer Research" (Apr. 25-29).

Apr. 27

Christchurch.—R.Ae.S. Christchurch Branch A.G.M. and lecture, "Operational Problems in Supersonic Flight Testing," Wg. Cdr. R. P. Beamont, at the King's Arms Hotel, at 19.30 hrs.

Coventry.—R.Ae.S. Branch A.G.M. and film in the Herbert Art Gallery, at 19.30 hrs.

Hatfield.—R.Ae.S. Hatfield Branch lecture, "Supersonic Transports," by D. G. Brown, in the de Havilland Restaurant, at 18.15 hrs.

Lytham.—R.Ae.S. Preston Branch lecture, "From Aviation to Astronautics," by J. E. Allen, at the Queen's Hotel, at 19.45 hrs.

Weybridge.—R.Ae.S. Weybridge Branch A.G.M. at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., at 18.10 hrs.

Company Notices

NEW COMPANIES

Catalina Craft, Ltd. (651,995).—Private co. Reg. Mar. 9. Cap. £2,000 in £1 shs. Objects: To carry on the business of importers and builders of and dealers in aircraft, ships, boats, etc. Subscribers (each with one share): Sqn. Ldr. Harold S. Copland, 6 Firgrove Court, Firgrove Road, Farnborough, Hants; Mrs. Lotti A. L. Copland, 6 Firgrove Court, Firgrove Road, Farnborough, Hants; and Frank J. Evans, 5 Homesdale Road, Orpington, Kent. Sec.: W. G. K. Ames, 26 Northbrook Street, Newbury, Berks.

New Era Tool Developments, Ltd. (652,042).—Private co. Reg. Mar. 9. Cap. £1,000 in £1 shs. Objects: To carry on the business of designers, manufacturers of and dealers in aeronautical and scientific tools. Directors: William A. Norman, 18 Wilfrids Wood Close, Blind Lane, Flackwell Heath; Leslie R. Dean, 52 Southfield Road, High Wycombe. Sec.: L. R. Dean. Reg. off.: Lancaster Road, High Wycombe.

Tartan Arrow (Marine), Ltd. (652,196).—Private co. Reg. Mar. 10. Cap. £10,000 in £1 shs. Objects: To carry on the business of carriers of passengers and goods by land, water or air. Directors: John C. Chester, Eden Roe, Thorpe Bay; Derek W. Cooper, 166 Overton Drive, E.11; and Jack Hymans, 13 Olivia Drive, Leigh-on-Sea. Sec.: J. Hymans.

Express Cargo, Ltd. (652,265).—Private co. Reg. Mar 11. Cap. £100 in £1 shs. Objects: To carry on the business of chartering, freight, shipping and aircraft brokers and agents. Subscribers (each with one share): J. J. Moreton and D. P. Rosling, both of Saddlers Hall, Gutter Lane, E.C.2. Sols.: Stephenson, Harwood and Tatham, Saddlers Hall, Gutter Lane, E.C.2.

Baker Britt (Northern), Ltd. (652,393).—Private co. Reg Mar. 14. Cap. £10,000 in £1 shs. Objects: To carry on the business of wharfingers, ship, barge, boat and aircraft proprietors. Subscribers (each with one share): Frederick J. Britt, 16 Upper Thames Street, E.C.4; Frederick J. Britt, Junior, 21 Camden Mews, N.W.1. Sols.: Tucker Turner and Co., 5 Stone Buildings, W.C.2.

G. and P. Aeronautics (Scrap), Ltd. (653,020).—Private co. Reg. Mar. 18. Cap. £1,000 in £1 shs. Objects: To carry on the business of retailers, wholesalers, dealers in and manufacturers and repairers of aircraft components, accessories and fittings. Directors: Frederick C. Govier, 8 Audley Road, Ealing, W.5; Norman W. Angel, 87 Smith Lane, Dedworth, Nr. Windsor. Sec.: David M. Nunn. Sols.: H. B. Wedlake, Saint and Co., 420 Seven Sisters Road, N.4. Reg. off.: 30 Clarendon Road, Harrow, Middx.

City Transit, Ltd. (653,080).—Private co. Reg. Mar. 18. Cap. £100 in £1 shs. Objects: To establish, maintain and operate shipping, air transport and road transport services. Subscribers (each with one share): Dorothy M. Graeme and Gordon V. Graeme, both of 61 Fairview Avenue, Gillingham, Kent. Sec.: Gordon V. Graeme.

CHANGES OF NAME

Aero Motor Spirit Company Ltd. (259,063), Ripple Road, Dagenham, Essex.—Name changed to Aero Petroleum Co. Ltd., on Nov. 5, 1959.

Air Trainers Link Ltd. (426,402), Aldermanbury House, Aldermanbury Square, E.C.2.—Name changed to General Precision Systems Ltd., on Oct. 30, 1959.

New Patents

APPLICATIONS ACCEPTED

835,563.—**M.L. Aviation Co., Ltd.**—"Altimeters."—Jan. 16, 1958. (Oct. 23, 1956.)

835,658.—**British Messier, Ltd.**—"Aircraft Undercarriages." May 2, 1958. (Addition to 806,024.)

Printed specifications of the above will be available on May 25, 1960, and the opposition period will expire on Aug. 25, 1960.

Personal Notices

BIRTHS

Black.—On Apr. 1, at Holybank, Leicester Road, Market Harborough, to Patricia, wife of Sqn. Ldr. F. A. Black, R.A.F. (Retd.)—a son.

Diffey.—On Mar. 30, at the R.A.F. Hospital, Wroughton, Wiltshire, to Ruth (*née* Rice), wife of Flt. Lt. K. S. Diffey—a son.

MARRIAGE

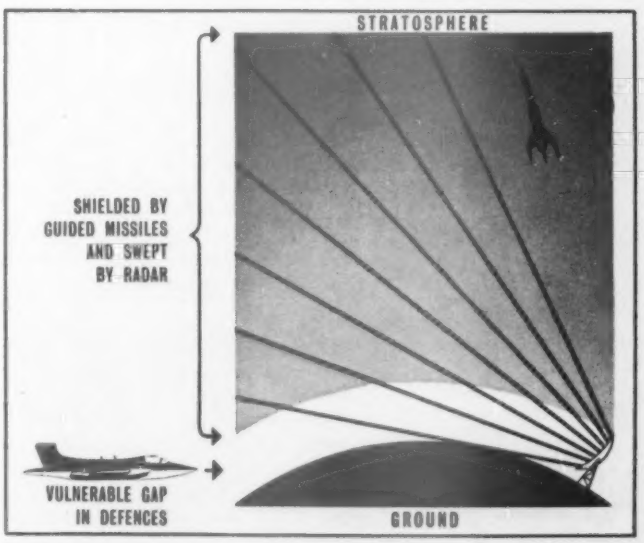
Harris—Miller.—On Apr. 2, at St. Mary's Church, Stoke D'Abernon, Surrey, Flg. Off. Malcolm Anthony Verder Harris, to Carolyn Angela Miller.

"The NA.39 is ahead" *

The most modern and advanced techniques in design and production have ensured that Great Britain now has the finest aircraft for the special role it has to perform—and on time.

Of this aircraft the Ministry of Defence has stated:

* "*In the low-level strike role, the NA.39 is ahead of any other aircraft in the world.*"

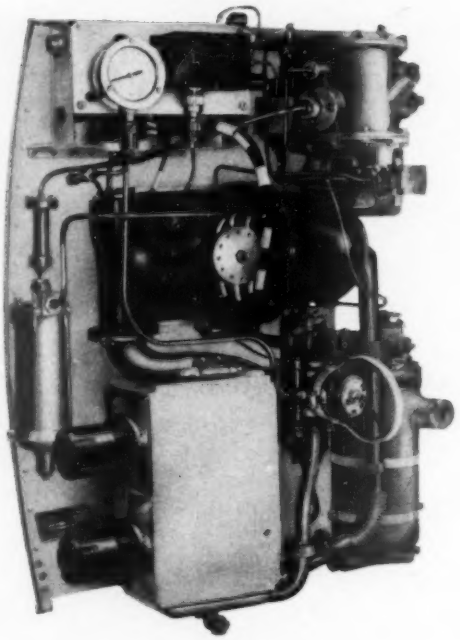


Blackburn

BLACKBURN AIRCRAFT LIMITED BROUGH YORKSHIRE

OA149/a

Packaged Refrigeration



Godfrey vapour cycle cooling packages, now in production, incorporate high efficiency Godfrey/SRM screw type refrigerant compressors. Driven by a 400 cps 200v 3 phase AC motor the compressor is coupled to the motor and hermetically sealed in a common casing. The Type VCP-1 package dissipates a heat load of 3.7 tons at an evaporating temperature of 55 deg C and a condensing temperature of 160 deg F.
Dimensions: 22.25 x 13.00 x 30.20 in.

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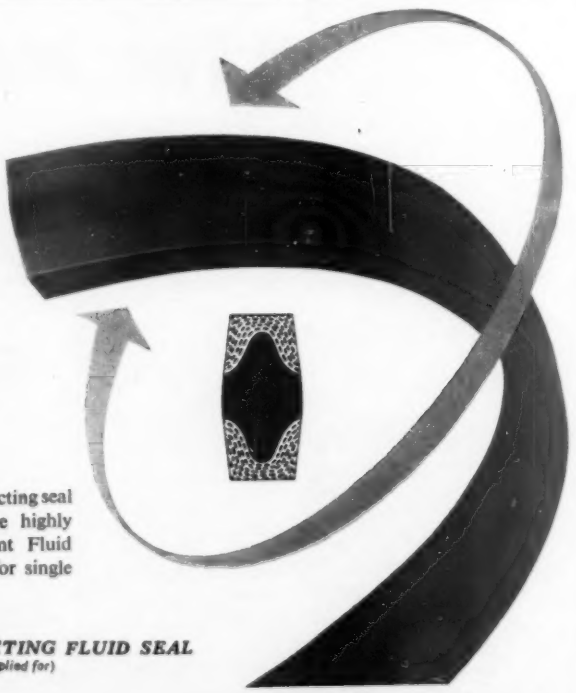
- ★ One seal replaces two



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P.4095

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EUROPE'S LEADING AIRCRAFT BROKERS.

OUR current score of different aircraft sold in the past quarter of a century has now reached 153 with two new types, Cessna 150 and 175. With new aeroplanes in mind we are setting out a list of some of the interesting new types which are promised exhibits at Kidlington for the

SHACKLETON SALES WEEK-END.

OXFORD AIRPORT, KIDLINGTON.

MAY 6, 7 AND 8, 1960.
11 a.m. to 6 p.m.

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AUSTER Autocar D6 and D4.
BEECHCRAFT Bonanza.
BELLANCA 260
GARLAND AIRCRAFT CO. Linnet.
PIAGGIO P.166.
AEROMERE Falco.
CESSNA 150, 175, 180, 182, 210 and 310.
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AVIATION TRADERS, LTD., Prentice.
RHEIN FLUGZEUGBAU RW.3.
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NORCO ENGINEERING PZL-102 and PZL-101.
META-SOKOL.
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AND on behalf of Rollason Aircraft and Engines, Ltd.:—
TURBULENT.
JODEL 2- and 4-seat.
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AEROBATIC Tiger Moth.

W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. Phone, Hyde Park 2448-9. Cables, "Shackhud, London." 530-15

ROLLASONS pay full P.P.L. course at club of your choice when you contract to buy a Jodel. For details of this and of the Turbulent and rebuilt Tiger Moths, phone, Croydon 5151, or write Rollason Aircraft and Engines, Ltd., Croydon Airport. zzz-737

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AUSTER Alpha, full blind-flying panel, long-range tank, Gipsy Major engine, first £1,200 secures.

TIGER MOTH, first £375 secures. Lancashire Aero Club, Barton Aerodrome, Eccles, Lancs. 530-8965

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DOUGLAS DC6-A passenger-cargo convertible, $875,000.
DOUGLAS DC-6B, two available, $650,000 each.
DOUGLAS DC-4, large selection available, passenger-cargo convertible.
DOUGLAS DC-3 passenger-cargo convertible, wide doors, 500 hours S.M.O.H., £15 per hour on lease.
DOVE. Several available in good condition, airline configuration, from £9,000.
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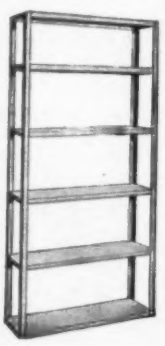

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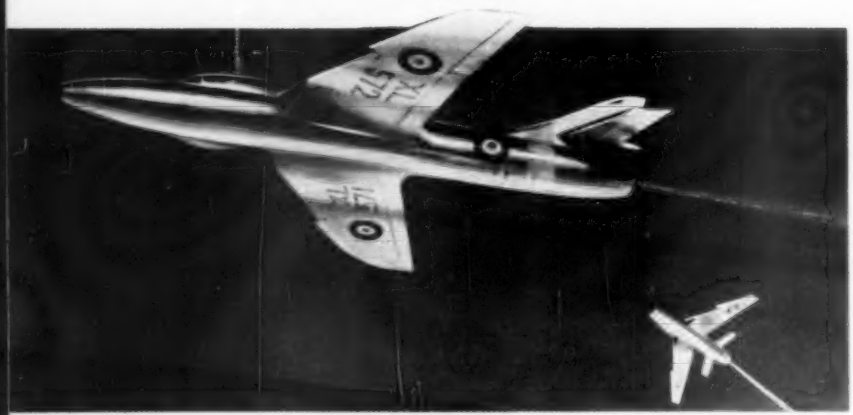

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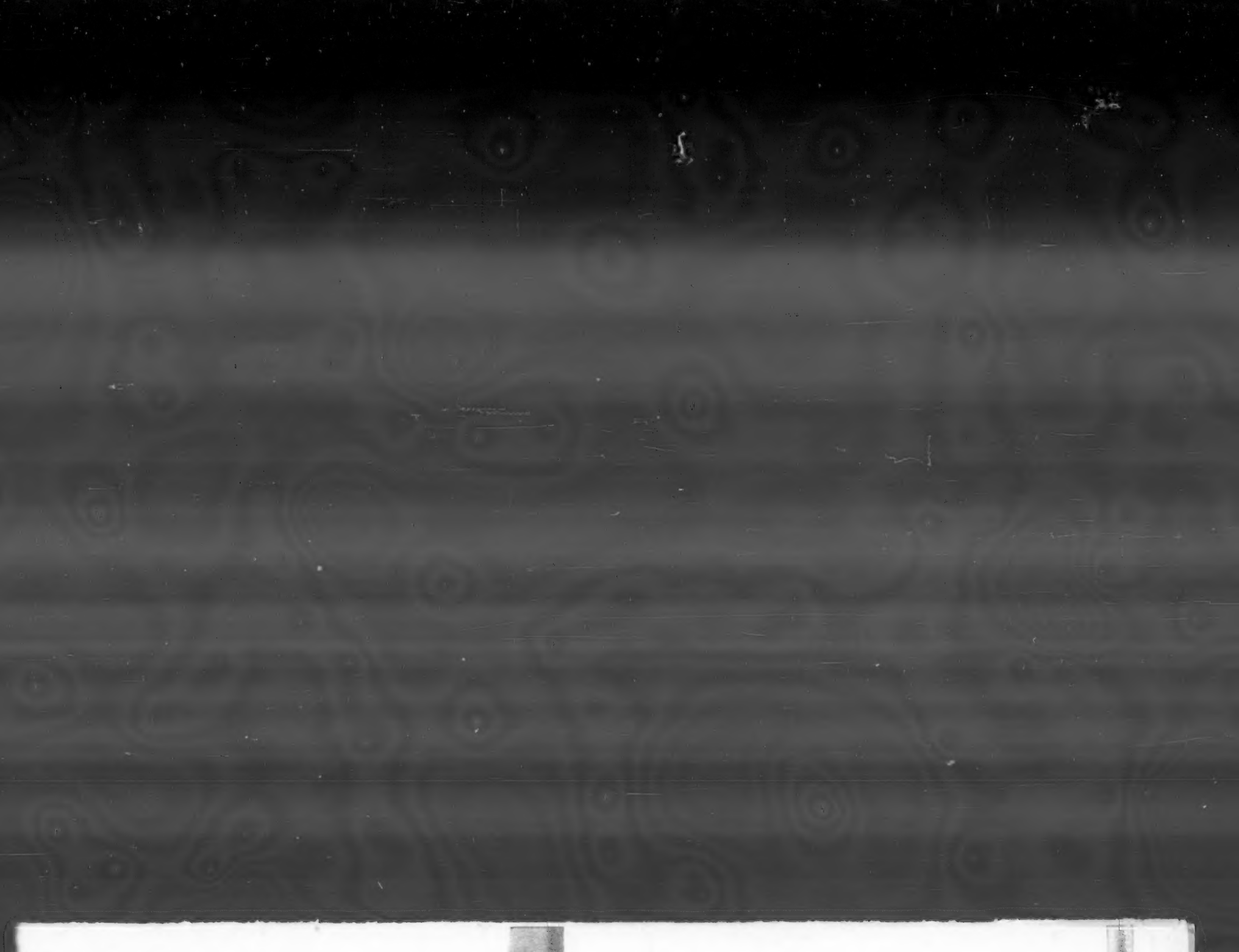
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